ANNUAL REPORT
to the
GOVERNMENTS
of
THE UNITED STATES
and
CANADA

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD
Washington, D. C. Ottawa, Ontario
30. SEPTEMBER 1968

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

CANADA · UNITED STATES

CANADIAN SECTION
G. M. MacNABB, Chairman
A. F. PAGET, Member

UNITED STATES SECTION
W. E. JOHNSON, Chairman
M. D. DUBROW, Member

31 December 1968

The Honourable Dean Rusk
The Secretary of State
Washington, D.C.

The Honourable J.J. Greene
Minister of Energy, Mines and Resources
Ottawa, Ontario

Gentlemen:

Reference is made to the Treaty between the United States of America and Canada, relating to co-operative 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), there is submitted herewith the fourth Annual Report, dated 30 September 1968, of the Permanent Engineering Board.

The report sets forth results achieved and benefits produced under the Treaty for the period from 1 October 1967 to 30 September 1968.

Respectfully submitted:

For the United States

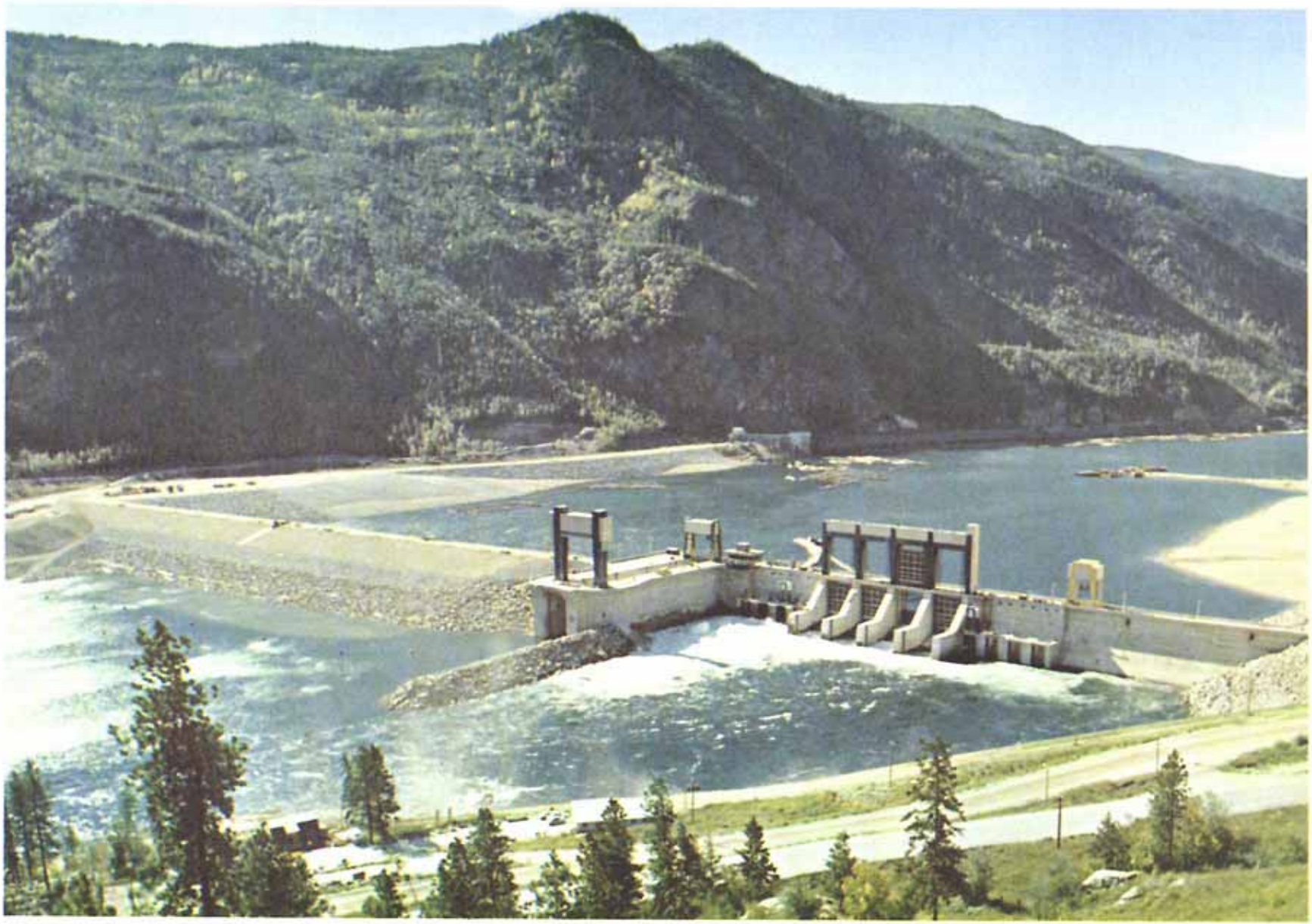
Wendell E. Johnson, Chairman

Morgan D. Dubrow

For Canada

G.M. MacNabb, Chairman

A.F. Paget



ARROW DAM — the second of the Treaty projects to be completed.

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PERMANENT ENGINEERING BOARD

Washington, D.C. **Ottawa, Canada**

30 September 1968

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SUMMARY

The fourth 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 January 1961. Project construction, progress of Entity studies, and benefits realized from completion and operation of Duncan Dam and from partial operation at Arrow Dam are described.

Three Board meetings and three meetings of the Board with the Entities were held during the reporting period. The Board also inspected the Mica, Arrow and Libby projects during the month of September 1968.

The United States transferred to Canada the sum of $11,100,000 in United States funds ($11,929,031.25 in Canadian funds) on 22 November 1967 as a result of completion of Duncan Dam on 31 July 1967. Early completion of the project also provided additional energy and flood control benefits to both countries.

Arrow Dam was declared operational on 10 October 1968 well in advance of the date, 1 April 1969, scheduled in the Sales Agreement. The flood control payment of $52,100,000 in United States funds ($55,909,812.50 in Canadian funds) was paid to Canada on the date full operation was commenced. Additional energy benefits will be realized in both countries as a result of the early completion. Work on the Mica and Libby projects is on schedule.

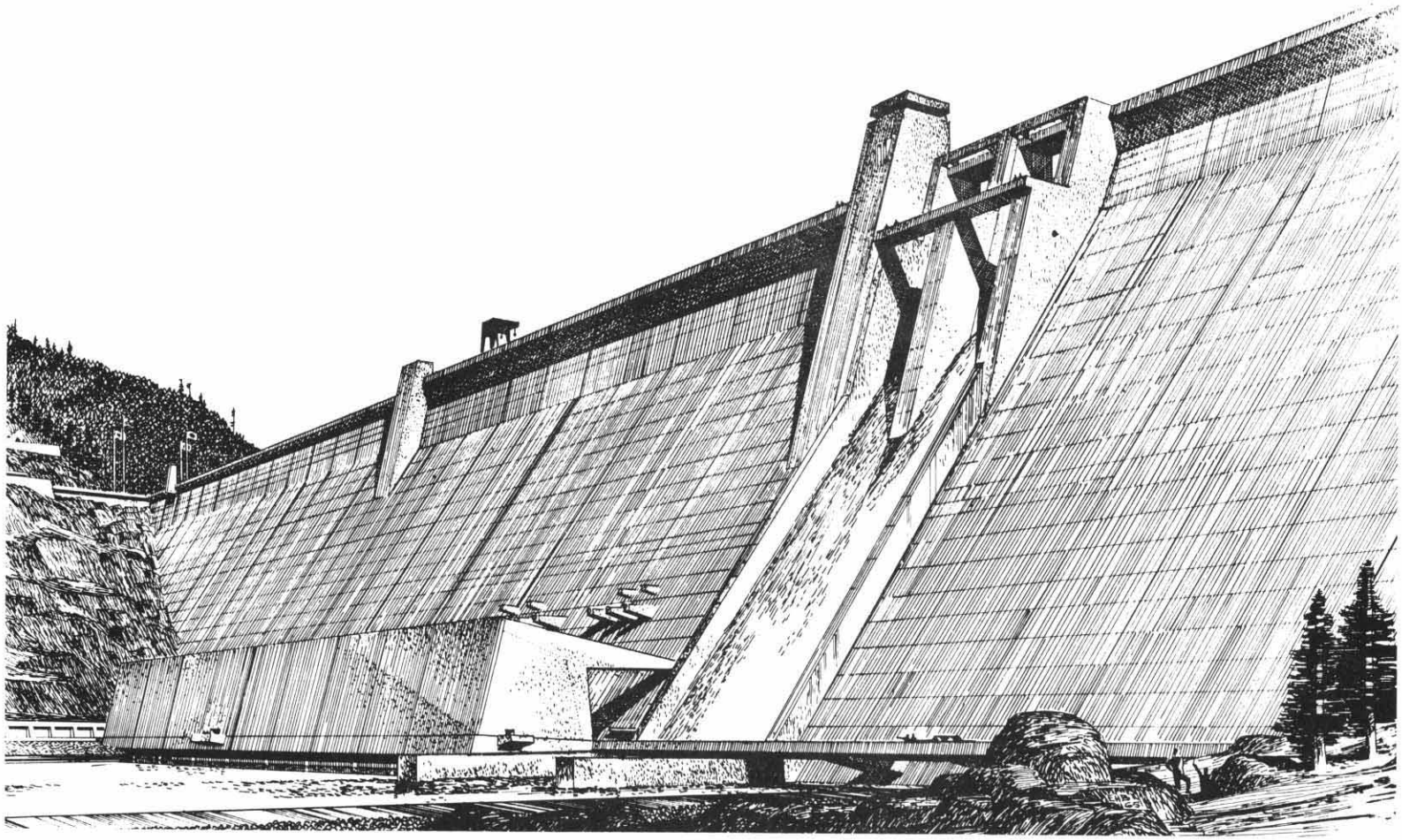
Studies concerning the hydrometeorological network and power and flood control operation are being continued by the Entities to ensure operation of the projects in accordance with the terms of the Treaty. Studies of project discharge capacities and of initial reservoir filling are complete.

The Board concludes that the objectives of the Treaty are being met.

INTRODUCTION

The Columbia River Treaty, which provides for co-operative development of the water resources of the Columbia River basin, was signed at Washington, D.C. on 17 January 1961 by representatives of the United States and Canada. Article XV of the Treaty established a Permanent Engineering Board and specified that one of its duties would be 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 the period 1 October 1967 to 30 September 1968, indicates activities of the Board, progress being achieved by both countries under the terms of the Treaty, and the benefits being realized from operation of Treaty projects. The report also indicates whether, in the opinion of the Board, the objectives of the Treaty are being met. Summaries of the essential features of the Treaty and of the responsibilities of the Board and of the Entities are included.



LIBBY PROJECT

Kootenai River, Montana

A perspective drawing of the dam and powerhouse.

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 of that year. In Canada ratification was delayed. Further negotiations between the two countries resulted in 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 Treaty and related documents were approved by the Canadian Parliament 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 thirty 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 $253.9 million (U.S. funds) 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 the Peace Arch Park on the International Boundary the Treaty and its Protocol were proclaimed by President Johnson, Prime Minister Pearson, and Premier Bennett of British Columbia.

Features of the Treaty and Related Documents

The essential features of the Treaty are as follows:

(a) Canada will provide 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 generated 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 totalling $64.4 million (U.S. funds) 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 42 miles into Canada and Canada would make the necessary Canadian land available for flooding.

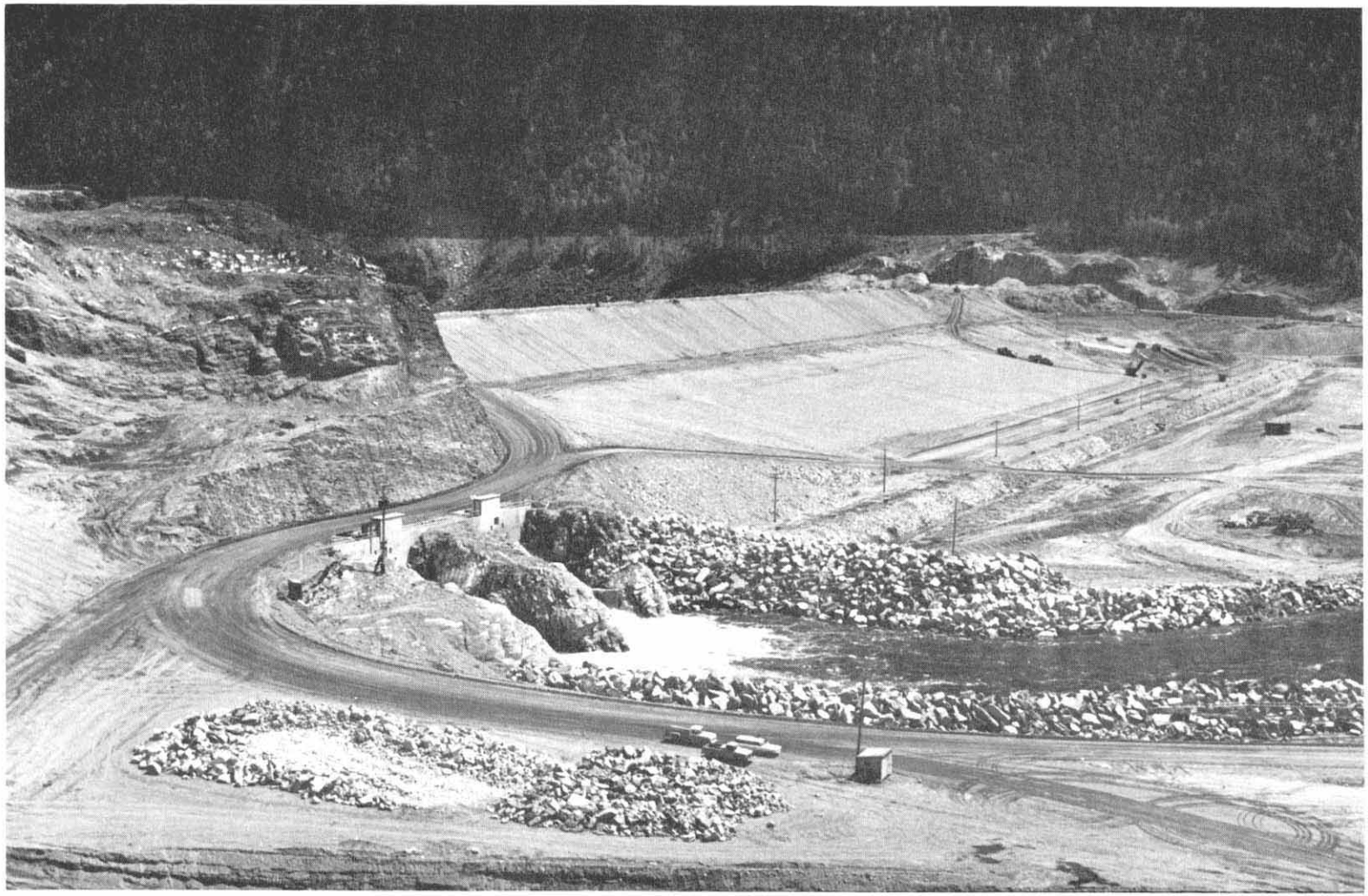
(f) Canada has the option of making specific diversions of the Kootenay River.

(g) Differences arising under the Treaty which cannot be resolved by the two countries may be referred by either 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 Canadian Entitlement Purchase Agreement of 13 August 1964 provided that the Treaty storages would be operative for power purposes on the following dates:

Duncan storage	1 April 1968
Arrow storage	1 April 1969
Mica storage	1 April 1973



DUNCAN DAM

Duncan River, British Columbia

The dam showing discharge works in operation.

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 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 appointed two members and two alternate members to form the United States Section of the Permanent Engineering Board. The members of the Canadian Section of the Board were appointed by Order in Council P.C. 1964-1671 dated 29 October 1964. Each member was authorized to appoint an alternate member. On 11 December 1964 the two governments announced the composition of the Board.

The names of the Board members, alternate members and secretaries are shown in Appendix A.

Duties and Responsibilities of the Board

The general duties and responsibilities of the Board to the governments, as set forth in 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;

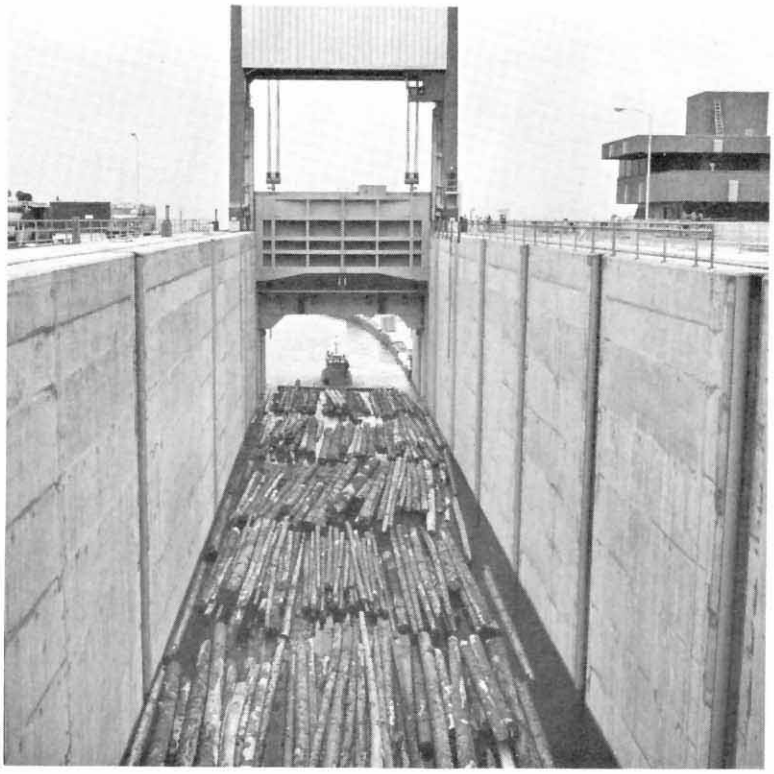
(d) making periodic inspections and requiring reports as necessary from the entities with a view to ensuring that the objectives of the Treaty are being met;

(e) making reports to Canada and the United States of America at least once a year of the results being achieved under the Treaty and making special reports concerning any matter which 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 of America;

(g) consulting with the entities in the establishment and operation of a hydro-meteorological system as required by Annex A of the Treaty.

In addition to these duties Article XV(4) of the Treaty states that the Board shall comply with directions, relating to its administration and procedures, agreed upon by the two governments as evidenced by an exchange of notes. A document entitled "Administration and Procedures", prepared by the Board, was approved by the two governments by a formal exchange of notes on 4 October 1965 and is included as Appendix C to this report. Since approval of this document a change in Departmental responsibility has occurred in the Canadian Government. The Canadian Section of the Board now reports to the Minister of Energy, Mines and Resources.



NAVIGATION LOCK
at Arrow Dam
passing a load of logs for
Celgar pulp and lumber mills.
September 1968.

ENTITIES

General

Article XIV(1) of the Treaty provides for the designation by Canada and the United States of entities which are empowered and charged with the duty of formulating and executing the operating arrangements necessary to implement the Treaty. Provision is made for either government to designate one or more entities. The powers and duties of the entities are specified in the Treaty and related documents.

Establishment of the Entities

Executive Order No. 11177, previously referred to, designated the Administrator of the Bonneville Power Administration, 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 Chairman. Order in Council P.C. 1964-1407 dated 4 September 1964 designated the British Columbia Hydro and Power Authority as the Canadian Entity for the purposes of the Treaty.

The names of the members of the two entities are shown in Appendix B. Mr. H. R. Richmond, Administrator, Bonneville Power Administration, became Chairman of the United States Entity effective 20 October 1967.

Powers and Duties of the Entities

In addition to the powers and duties specified elsewhere in the Treaty and related documents the Treaty requires that the entities be responsible for:

(a) co-ordination 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 of America 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) assisting and co-operating 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,

(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.

120 TON EARTH MOVER
About 50 of these huge belly-dump vehicles will haul fill for Mica Dam. September 1968.

ACTIVITIES OF THE BOARD

Meetings

The first Board meeting of the report year was held in Ottawa, Ontario on 23–24 October 1967 to review progress and to draft the 1967 report to governments. A meeting was also held with the Entities on 23 October 1967 to receive information on Entity studies. The second meeting of the Board was held in Seattle, Washington on 30 April 1968 to discuss progress of project construction and of Entity studies. A joint meeting was held with the Entities on the same day. The final Board meeting of the report year was held in Richmond, B.C. on 17 September 1968 and on 19 September 1968 a joint meeting was held with the Entities to receive information on Entity studies.

Field Inspections

On 17 and 18 September 1968 the Board visited the Mica, Arrow and Libby projects to assess construction progress.

Reports Received

The Board received quarterly reports from the Canadian Entity indicating construction progress of the Canadian Treaty projects and semi-annual reports from the United States Entity on construction progress of the Libby project.

Semi-annual progress reports were received from the Entities on their studies relating to the hydrometeorological network, power operating plans, and flood control

operating plans. Entity studies relating to initial reservoir filling plans and project discharge capacity were completed during the year, hence only one progress report was received on each subject.

In November 1967 the Entities provided the Board with a copy of their signed agreement on definition of the Columbia River Treaty Hydrometeorological System, and, in March 1968, with copies of similar agreements on Hydrometeorological Recommendations 1, 2, and 3 which relate to streamflow stations, snow courses and meteorological stations respectively.

In April 1968 the Entities provided the Board with the following documents and with a copy of their signed agreement on each document:

- Special Operating Plan for Duncan Reservoir During the Period 1 August 1967 through 31 July 1968
- Interim Flood Control Operating Plan for Duncan Reservoir – 1967-68
- Special Operating Program for Canadian Storage During the Period 1 April 1968 through 30 June 1969
- Mica Project Discharge Capacity.

BEDROCK PREPARATION
at the Libby Project. Footing for monolith 32 being prepared for concrete placement. September 1968.

In September 1968 the Board received the following documents and a copy of the signed agreement on each document from the Entities:

- Procedures for the Determination of Downstream Power Benefits Resulting from Canadian Storage
- Special Operating Plan for Canadian Storage During the Period 1 August 1968 through 31 July 1969.

In September 1968 the Entities also supplied the Board with the following documents and reports:

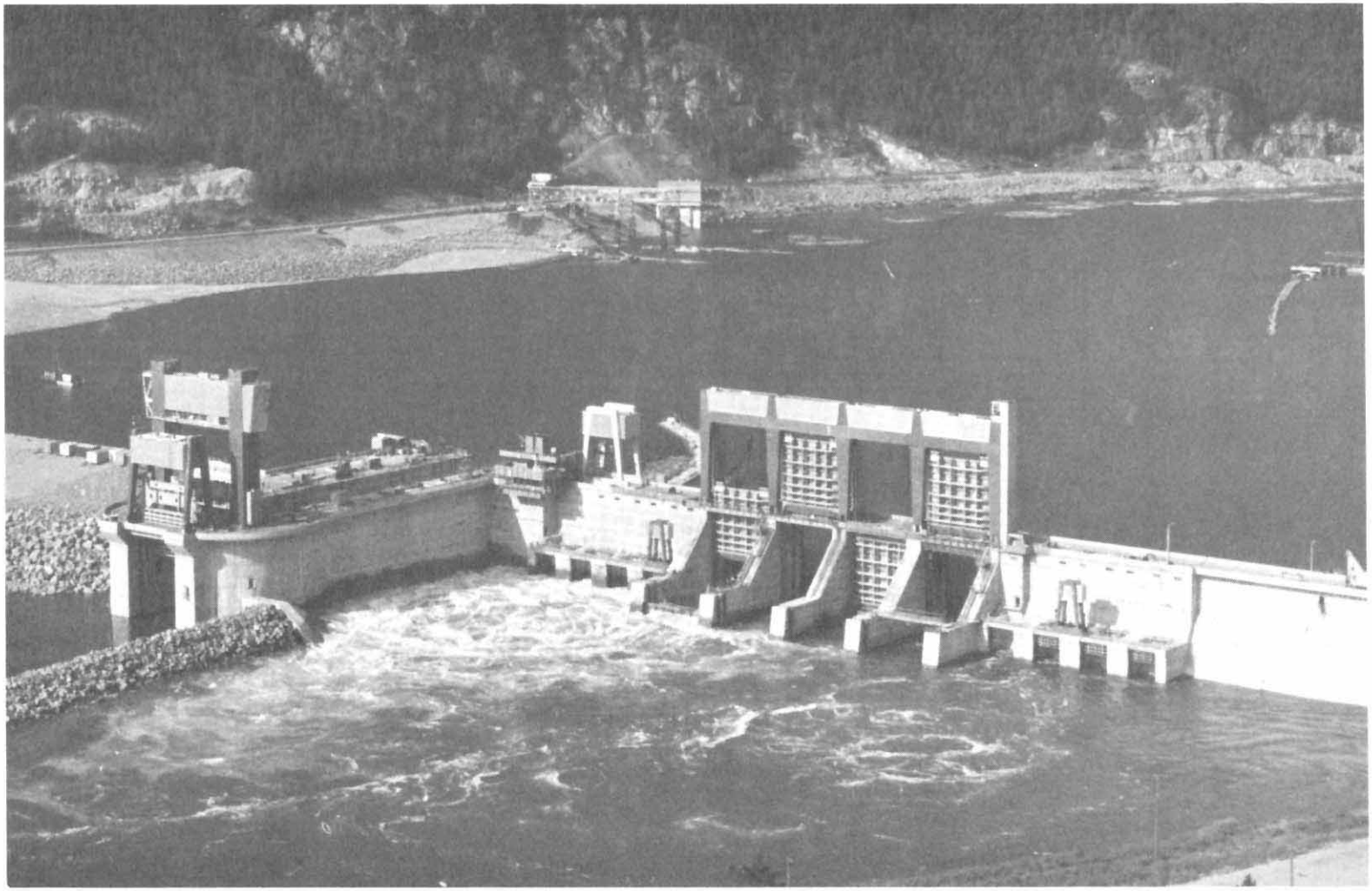
- Report of Columbia River Treaty Canadian and United States Entities for the Period 16 September 1964 to 30 September 1967
- Columbia River Treaty Hydrometeorological Network Supporting Facilities
- Hydrometeorological Network Recommendation No. 5
- Terms of Reference for the Columbia River Treaty Hydrometeorological Committee
- Terms of Reference for the Columbia River Treaty Operating Committee.

Committee

The committee established by the Board under the provisions of section 7 of the Board's Administration and Procedures continued to assist the Board in considering proposals and operating plans received from the Entities.

Report to Governments

The third Annual Report of the Board was submitted to the two governments on 31 December 1967.



ARROW DAM

Columbia River, British Columbia

Low-level ports in operation, sluiceways and navigation lock. July 1968.

PROGRESS

General

The results achieved under the terms of the Treaty include progress on construction of the Treaty projects and on studies regarding development of the hydro-meteorological network, reservoir filling plans, power and flood control operating plans, project discharge works and the annual calculation of downstream power benefits. The locations of the Treaty projects are shown on Plate 1.

Duncan Dam was completed and placed in operation on 31 July 1967, during the previous report year. It has continued to produce both power and flood control benefits.

Construction Progress of the Treaty Projects

Arrow Project

Arrow Dam, scheduled by the Sales Agreement for operation by 1 April 1969, was the second Treaty project to become operative. This project was declared operational on 10 October 1968, just after the end of the Board's report year.

As shown on Plate 2, the Arrow project consists of two main components: the concrete gravity structures including the spillway, low-level outlets, and navigation lock; and a zoned earthfill embankment with an impervious upstream blanket across the present

MICA PROJECT

Columbia River, British Columbia

Looking downstream at the site. Preparation of the right abutment is in progress. September 1968.

river channel. A drawing of the earth dam is shown on Plate 3, the picture on page 16 shows the concrete gravity structures, and the frontispiece shows the completed project.

Acquisition of land, relocation or dyking of certain communities in the reservoir area and reservoir clearing have proceeded satisfactorily.

Mica Project

Mica dam, the largest of the Treaty projects, is scheduled by the Sales Agreement for initial operation on 1 April 1973.

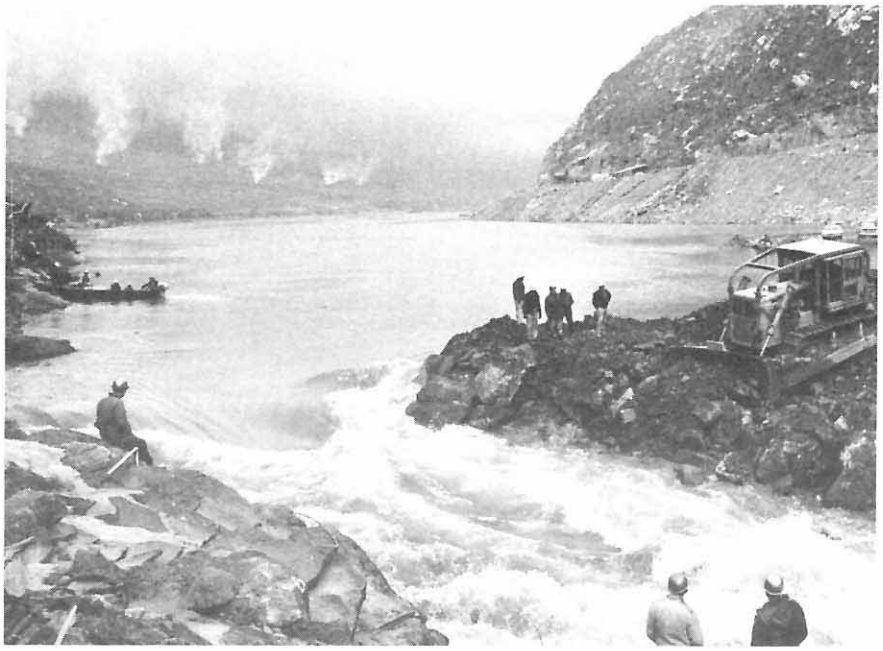
The general arrangement of structures for the Mica project is shown on Plate 4. The main dam will have a nearly vertical impervious core supported between zones of coarser material. The two 45-foot diameter diversion tunnels through the left abutment and the two main cofferdams are complete. Diversion of the Columbia River was effected on 6 November 1967, see picture on page 20. Spillway facilities and control works to provide regulated discharges from storage will be constructed in the left abutment and power facilities will be located underground in the right abutment.

General progress of excavation of the river-bed overburden for the main fill is shown on Plate 5 and in the picture on page 18. Excavation of the core trench to bedrock is complete and rock excavation is proceeding on the abutments.

Construction of haul roads along both sides of the Columbia River is well advanced. The Wood River has been diverted into the Canoe River and five large

multiplate culverts are being installed to pass the flow of the combined rivers under the right bank haul road. Preparation of main borrow areas is continuing.

The Big Bend Highway between Revelstoke and the Mica project has been reconstructed and paved.

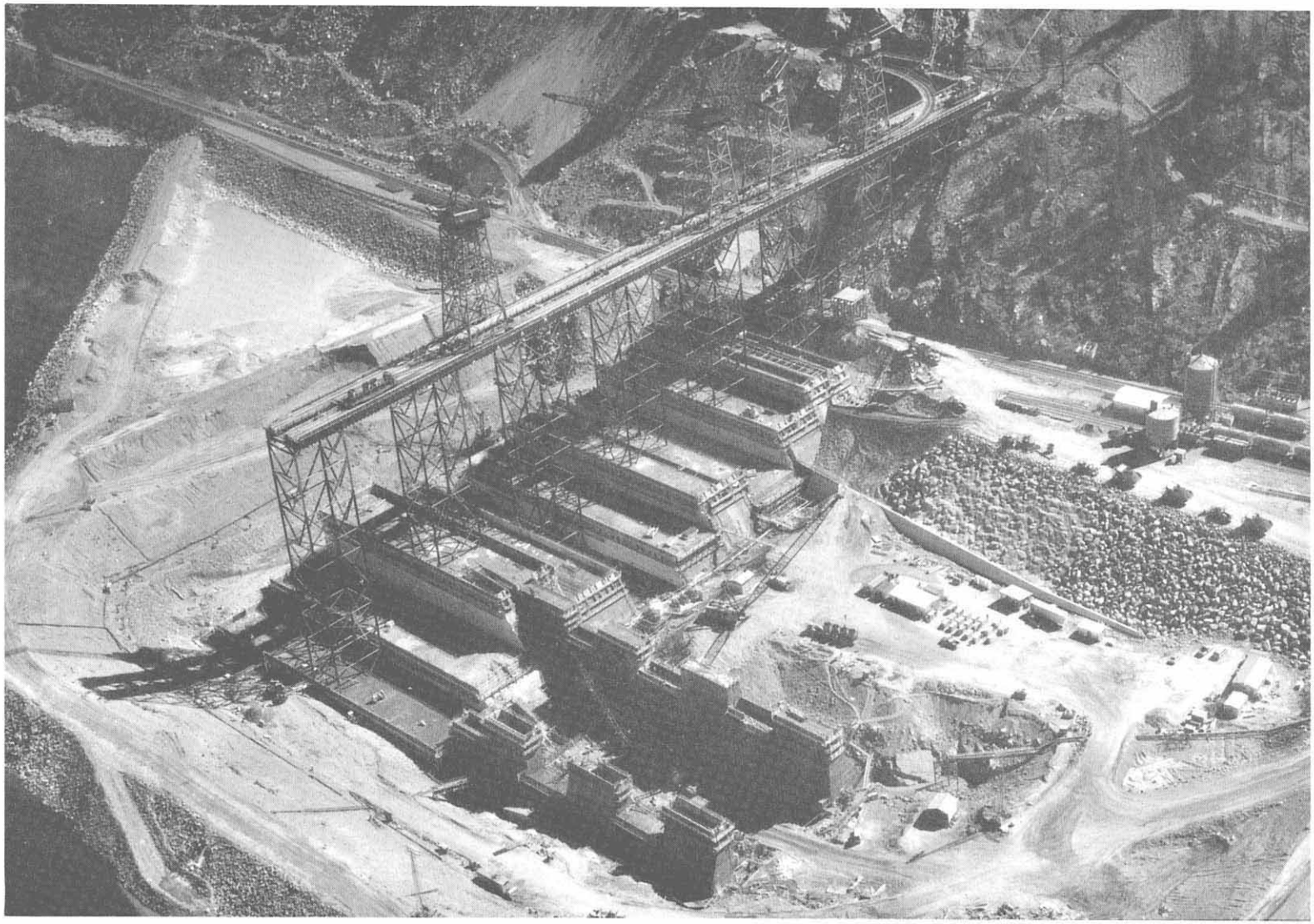


COFFERDAM CLOSURE

at Mica Project was effected in November 1967.

Libby Project

Libby dam is the fourth and last of the Treaty projects to be placed under construction. Initial phases, including highway and railroad relocations, were commenced in June 1966. In accordance with Article XII of the Treaty the dam is to be operational by 30 June 1973.



LIBBY PROJECT

Kootenai River, Montana

Concrete being placed inside the first stage cofferdam for the east bank monoliths and spillway. September 1968.

The general arrangement of the structures is shown on Plate 7, and the reservoir area and the required highway and railroad relocations are depicted on Plate 8. The concrete gravity dam will be capable of storing water up to elevation 2,459 feet, and the reservoir, with a total length of 90 miles, will extend some 42 miles into British Columbia. Procurement and preparation of the land required for the portion of the reservoir in Canada will, in accordance with the terms of the Treaty, be the obligation of the Canadian Government.

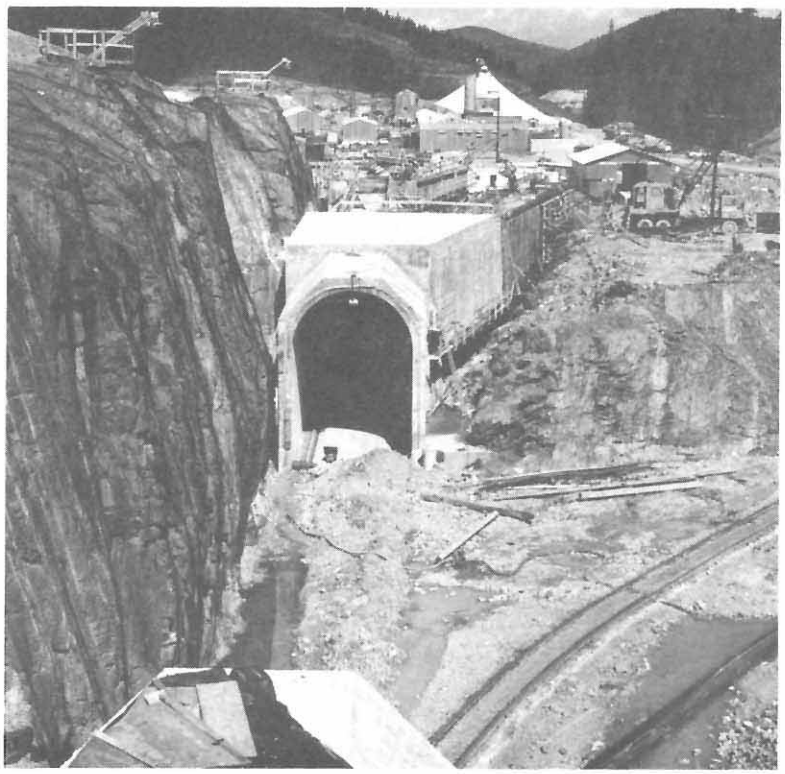
The dam will consist of non-overflow monoliths, powerhouse intake and spillway monoliths. The spillway monoliths will contain two radial-type crest gates, and the outlet works will be combined into the same section to utilize a common stilling basin. A roadway and sidewalks will be provided over the dam. The powerhouse will provide space for eight generating units for a total installed capacity of 840,000 kw. Initial installation will be 420,000 kw.

All grading contracts for the Great Northern Railroad relocation have been awarded and are proceeding on schedule. The seven-mile railroad tunnel was "holed-thru" on 21 June 1968.

Contracts awarded to date for road and highway relocations are proceeding on schedule. The contract for the first part of the Forest Development Road has been completed, approach roads are under construction, and concrete is being placed for the piers at the reservoir bridge.

At the dam site the first stage cofferdam was completed and the river diverted in January 1968. Since the first concrete was placed in the dam on 1 June 1968 concrete placement has averaged 4,200 cubic yards per day. The vista point and other facilities for visitors on the right abutment have been completed.

Expansion of Lincoln County school facilities is continuing with the construction of a new Libby Junior High School started in June 1968. An air-strip to serve the project is under construction at Kelly Flats.



RAILWAY TUNNEL

Libby Project.
Looking north at work on ventilating installations at the North Portal.
September 1968.

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 will include snow courses, precipitation stations and streamflow gauges.

As described in the Board's previous Annual Reports, the Entities, with the concurrence of the Board, adopted requirements for the addition of a number of new snow courses and for additional reservoir and streamflow gauges to form part of the hydrometeorological network. The snow courses were established during the 1966 report year. Installation of the reservoir and streamflow gauges is proceeding satisfactorily.

In the preceding report year the Entities provided the Board with a document defining the Columbia River Treaty Hydrometeorological System Network and setting forth a method of classifying facilities into those required as part of the Treaty System and those of value as Supporting Facilities. The Entities also provided the Board with recommendations for classifying previously adopted facilities and for existing and new meteorological stations and additional snow courses which should be added to the general hydrometeorological network.

In this report year the Entities, with the concurrence of the Board, adopted the document defining the Treaty System and the requirements for existing and new meteorological stations. The Board indicated its agreement with the recommendation for additional snow courses.

DIVERSION TUNNELS – Discharging the 1968 freshet past the site of Mica dam. June 1968.

At the end of this report year the Entities supplied the Board with a recommendation for additional reservoir and streamflow gauges which should be added to the Treaty System. The Board is considering this recommendation. The Entities also provided the Board with a complete listing of supporting facilities and with a copy of the terms of reference for the Entities' newly formed Columbia River Treaty Hydrometeorological Committee.

Power Operating Plans

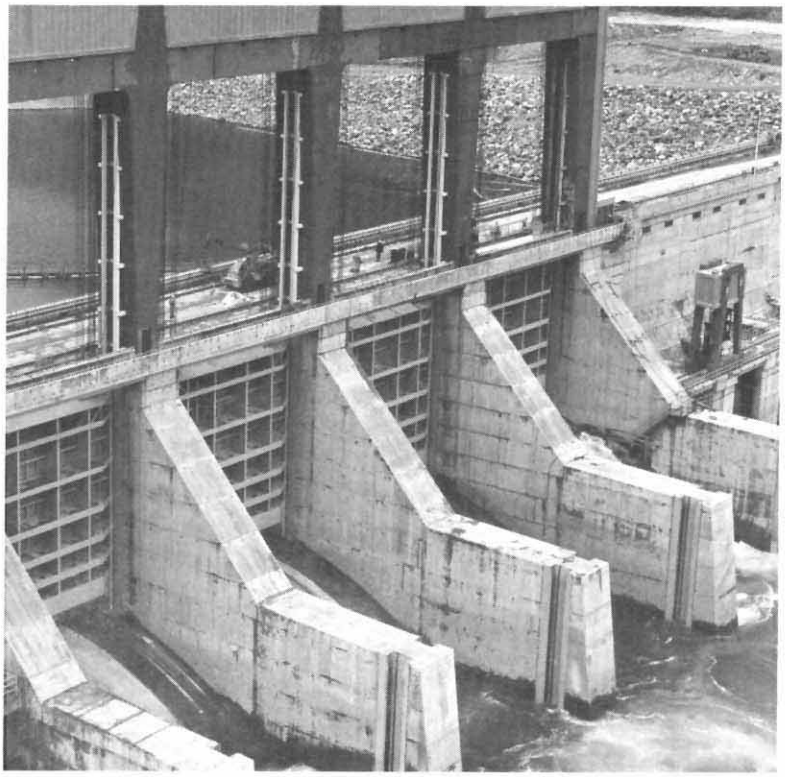
The Treaty and related documents provide that before the Duncan reservoir becomes fully operative the Entities will agree on operating plans and downstream power benefits for each year until the total of 15,500,000 acre-feet of storage in Canada becomes operative. In addition, based on the terms of the Treaty, the Entities are to agree annually

on operating plans and on the resulting downstream power benefits for the sixth succeeding year of operation.

For the first part of this report year the Duncan reservoir was operated in accordance with a special operating plan which the Entities had adopted for the period 1 August 1967 through 31 July 1968. This plan was developed under the terms of the special operating program for Duncan reservoir which had been approved by the two governments in the preceding report year.

Early in this report year the Entities agreed that partial storage could be operated in the Arrow reservoir prior to the scheduled completion date of 1 April 1969. As the partial operation could not be included in an assured operating plan, and because of the inter-relation between the Arrow and Duncan storages, the Entities did not consider assured operating plans appropriate for either reservoir at this time. The Entities therefore agreed on a special operating program for Canadian storage covering arrangements for operation and downstream benefits during the period 1 April 1968 through 30 June 1969. This program was forwarded to the two governments for approval.

Later in the report year the Entities agreed on a special operating plan for Canadian storage for the period 1 August 1968 through 31 July 1969 and operated in accordance with this plan for the last two months of the report year. At the end of the report year the Entities formed a Columbia River Treaty Operating Committee.



SLUICEWAYS COMPLETED
at Arrow Dam.
September 1968.

Annual Calculation of Downstream Benefits

The general requirements for determination of assured operating plans and downstream power benefits are summarized in the preceding section.

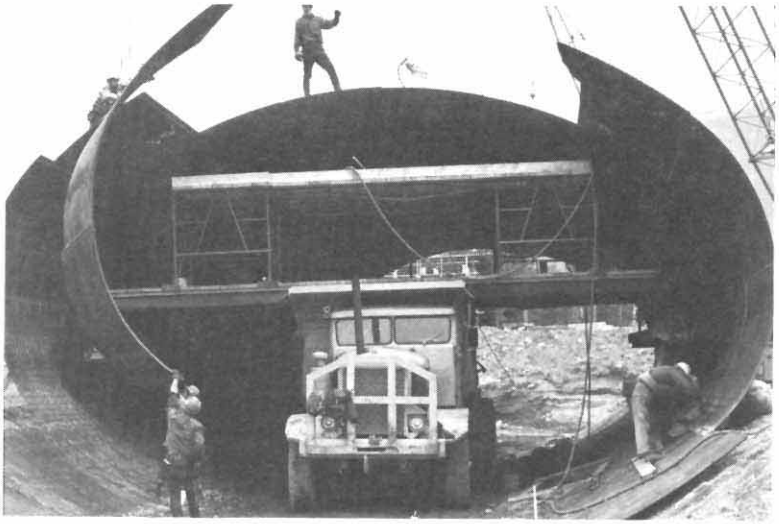
In this report year the Entities carried out preliminary work pertaining to the calculation of downstream power benefits. At the end of the report year the Entities provided the Board with a document describing procedures for the determination of downstream power benefits from Canadian storage. The Board is reviewing this document.

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.

During the report year the Entities continued studies to develop a flood control operating plan for the Canadian Treaty storage. The Entities agreed on an interim flood control operating plan to establish flood control requirements for the Duncan reservoir to the end of the 1968 freshet.

The Entities' flood routing and reservoir regulation studies for the 1975 level of development are nearing completion. Studies are being run to ensure compliance with reservoir operating criteria and power requirements. A draft of a flood control operating plan for Columbia River Treaty storage has been prepared by the Entities.



GIANT CULVERTS
five in number will pass the flow of Wood and Canoe Rivers under a haul road.
September 1968.

Project Discharge Works

Paragraph 3 of Annex A of the Treaty specifies that sufficient discharge capacity will be provided at each of the Treaty dams to afford the desired regulation for power and flood control as mutually agreed on by the Entities. Prior to this report year the Entities had agreed on discharge capacities for the Arrow and Duncan projects and on a reduced minimum average weekly discharge from the Duncan project.

In this report year the Entities agreed on the discharge capacity for the Mica project. The Entity studies on project discharge capacities were completed during the report year.

RESERVOIR CLEARING
for the Arrow Project.
Debris piled in wind-rows
ready for burning.

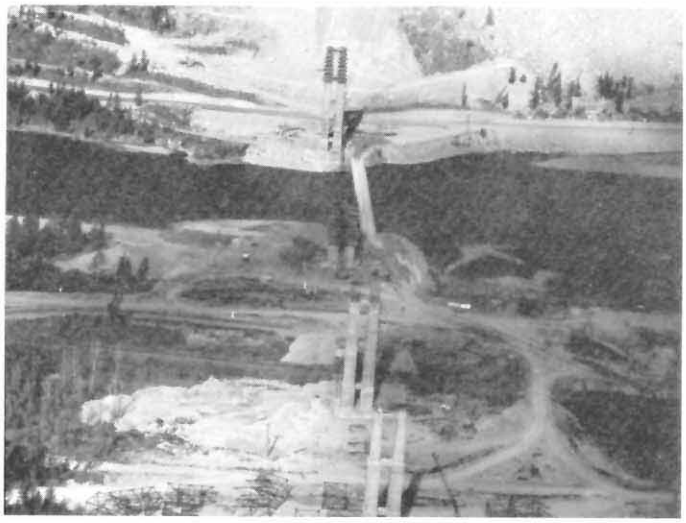
Reservoir Filling

In the preceding report year the Entities adopted initial filling programs which had been developed for each of the Canadian storage reservoirs. No further studies were done in this report year.

Flow Records

Article XV(2)(a) of the Treaty specifies that the Permanent Engineering Board shall assemble records of flows of the Columbia and Kootenay Rivers at the Canada–United States of America boundary. Actual recorded flows for the Kootenai River at Porthill, Idaho, and for the Columbia River at Birchbank (see Plate 1) are tabulated in Appendix D for this report year.

In order to illustrate the effect of storage regulation at the International Boundary the Board decided that flows which would have occurred under pre-project conditions would be shown for the Columbia River at Birchbank. In the section on benefits this report shows hydrographs of actual and pre-project flows for Birchbank and for the Duncan project. It is noted that the pre-project hydrograph for Birchbank has been computed on the assumption that the effect of Duncan regulation and the regulation provided by storage on Kootenay Lake have been removed. No attempt has been made to calculate the effect of partial operation of the Arrow project.



RESERVOIR BRIDGE
for Libby Reservoir.
Bridge piers under
construction.
September 1968.

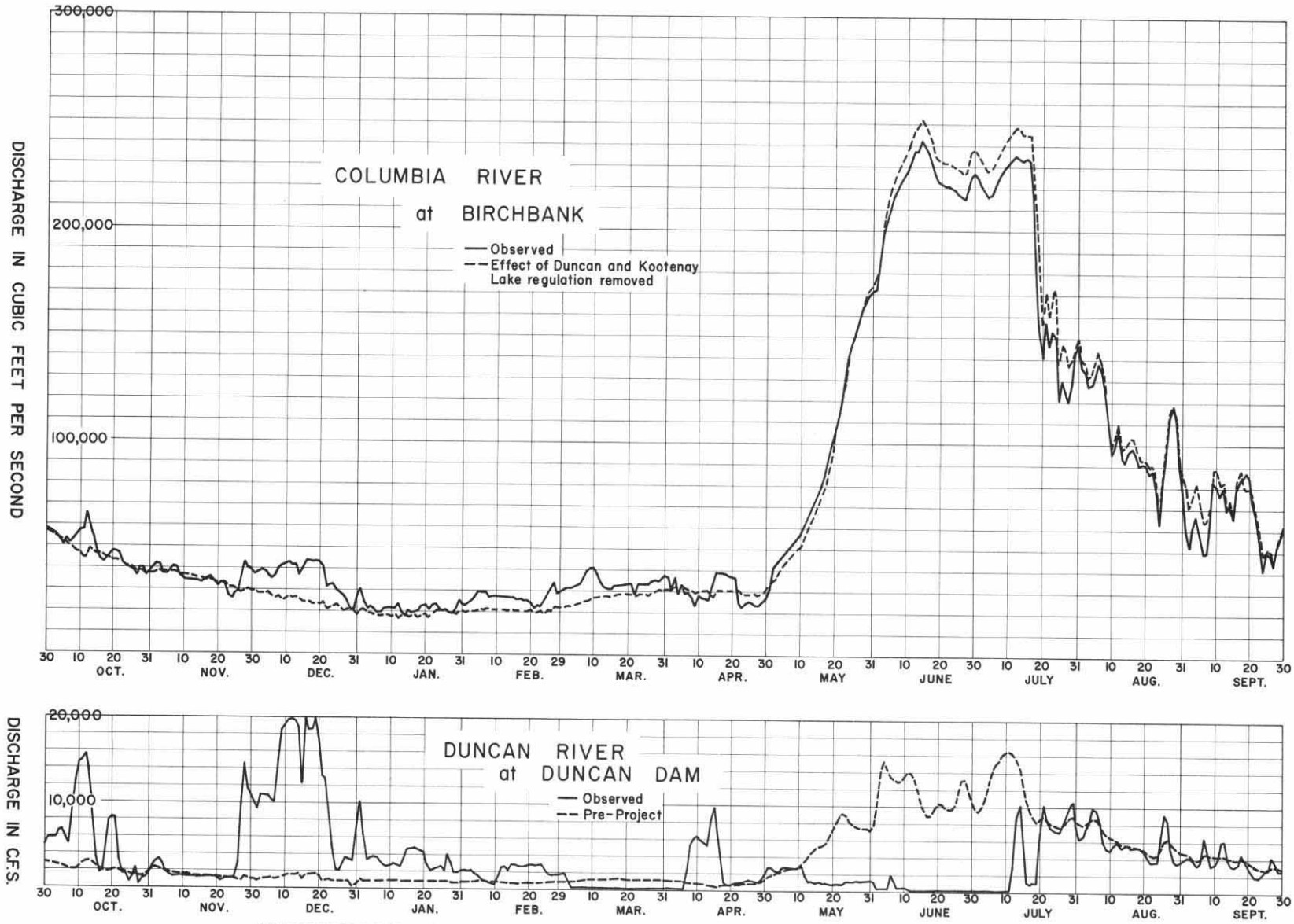
BENEFITS

Flood Control Payment

Article VI(1)(c) of the Treaty provides that the United States shall pay Canada $11,100,000 in United States funds upon commencement of operation of the storage at Duncan Dam. The dam was placed in operation on 31 July 1967 and the payment of $11,100,000 in United States funds ($11,929,031.25 in Canadian funds) was made to Canada on 22 November 1967. A payment of $198,000 in United States funds ($212,540.63 in Canadian funds) was made to Canada on 17 September 1968 in compensation for the delayed payment under the terms of Article XVIII of the Treaty.

Article VI(1)(b) of the Treaty provides that the United States shall pay Canada $52,100,000 in United States funds upon commencement of operation of the storage at Arrow Dam. The Arrow project was declared operational on 10 October 1968 and the flood control payment amounting to $55,909,812.50 in Canadian funds was received by Canada on the same day.

Article IV(6) of the Treaty requires that the Arrow storage shall commence full operation by September 1969. As the project was placed in operation on 10 October 1968 the storage will be effective in providing flood control against the 1969 freshet in addition to the period defined by the Treaty.



HYDROGRAPHS — Observed and pre-project flows for the year ending 30 September 1968.

Flood Control Provided

The effect of storage in the Duncan reservoir on flows at the site and on the Columbia River at Birchbank is illustrated on page 32 by hydrographs which show actual discharges and pre-project flows that would have occurred if the dam had not been built. It is noted that the pre-project hydrograph for Birchbank has been computed on the assumption that the effect of Duncan regulation and the regulation provided by storage on Kootenay Lake have been removed. It is also noted that the effect of partial storage in Arrow reservoir after the freshet peak has not been included in these calculations.

It is estimated that the Duncan project reduced the peak stage by about 1.1 feet on Kootenay Lake and by about 1.1 feet on the Columbia River at Trail, British Columbia.

The operation of Columbia Basin reservoirs for the system as a whole reduced the peak discharge of the Columbia River near The Dalles, Oregon by approximately 130,000 cfs to 415,000 cfs. The corresponding reduction in peak stage at Vancouver, Washington amounted to about five feet. The Duncan project contributed about ten percent of the total effective storage in the Columbia reservoir system during the period of control of the lower Columbia River.

Power Benefits

The special operating program for Duncan reservoir, approved by the two governments in the previous report year, made provision for operation of the project, for additional downstream power benefits during the period 30 April 1967 to 31 March 1968,

and for the delivery of a share of the estimated gain to Canada. During this report year a total of 415,450,000 kilowatt hours of electrical energy was received by the Canadian Entity under this program.

In recognition of the advance partial operation of the Arrow project the special operating program for Canadian storage, which has been passed to the two governments for approval, made provision for delivery of additional downstream power benefits during the period 1 April 1968 to 31 March 1969. To the end of this report year a total of 445,321,000 kilowatt hours of electrical energy was received under this program by the Canadian Entity. The total additional power benefits therefore amount to 860,771,000 kilowatt hours from the two projects.

In addition to the energy benefit Canada received an entitlement to a capacity benefit of 158 megawatts from partial operation of the Arrow project during the report year.

CONCLUSIONS

1. Duncan Dam was completed during the previous report year. Arrow Dam was declared operational on 10 October 1968 and the Mica and Libby projects are proceeding on schedule.

2. Entity studies on the hydrometeorological network, and on power and flood control operation are proceeding satisfactorily. Studies of project discharge capacities and of initial reservoir filling are complete.

3. The Duncan and Arrow projects have been operated in conformity with the provisions of the Treaty and special operating programs approved by an exchange of notes between the two governments.

4. Finally, the Board concludes that the objectives of the Treaty are being met.

APPENDIX A

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

United States	Canada
Members	
Mr. Wendell E. Johnson, Chairman Chief, Engineering Division, Civil Works Directorate, Office, Chief of Engineers, U.S. Army, Washington, D.C.	Mr. G.M. MacNabb, Chairman Assistant Deputy Minister, Energy Development, Department of Energy, Mines and Resources, Ottawa, Ontario
Mr. Morgan D. Dubrow Assistant and Chief Engineering Research Advisor, Office of the Assistant Secretary for Water and Power Development, Department of the Interior, Washington, D.C.	Mr. A.F. Paget Deputy Minister of Water Resources, Department of Lands, Forests, and Water Resources, Victoria, B.C.
Alternates	
Mr. Fred L. Thrall Chief, Water Conservation Branch, Civil Works Directorate, Office, Chief of Engineers, U.S. Army, Washington, D.C.	Mr. E.M. Clark Regional Engineer, Engineering Division, Department of Energy, Mines and Resources, Vancouver, B.C.
Mr. J. Emerson Harper Engineering Assistant, Office of the Assistant Secretary for Water and Power Development, Department of the Interior, Washington, D.C.	Mr. H.M. Hunt Chief, Power and Major Licences Division, Water Resources Service, Department of Lands, Forests, and Water Resources, Victoria, B.C.
Secretaries	
Mr. John W. Roche Engineer, Planning Division, Civil Works Directorate, Office, Chief of Engineers, U.S. Army, Washington, D.C.	Mr. E.M.Clark Regional Engineer, Engineering Division, Department of Energy, Mines and Resources, Vancouver, B.C.

APPENDIX B

COLUMBIA RIVER TREATY ENTITIES

United States

Mr. H.R. Richmond, Chairman

Administrator, Bonneville
Power Administration,
Department of the Interior,
Portland, Oregon

Brigadier General Elmer P. Yates

Division Engineer, North Pacific
Division,
Corps of Engineers, U.S. Army,
Portland, Oregon

Canada

Dr. H.L. Keenleyside, Chairman

Chairman, British Columbia
Hydro and Power Authority,
Vancouver, B.C.

APPENDIX C

ADMINISTRATION AND PROCEDURES

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

Administration and Procedures

1. Authority. The four-man Permanent Engineering Board was created, and its general duties outlined, by 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, D.C. on January 17, 1961, and the Annex to an Exchange of Notes dated January 22, 1964. The United States Section of the Board was provided for by Presidential Executive Order No. 11177 dated September 16, 1964. The Canadian Section of the Board was established by Order-in-Council P.C. 1964–1671 dated October 29, 1964 as amended by P.C. 1964–1976 dated December 17, 1964.

2. Composition of the Board. In conformance with Article 6(2) of the Canada-British Columbia Agreement of July 8, 1963 relating to the Treaty, and Order-in-Council 1964–1671, the Canadian Section of the Permanent Engineering Board shall consist of one member to be nominated and appointed by the Government of Canada who shall be Chairman of the Canadian Section, and one member to be nominated by the Province of British Columbia and appointed by the Government of Canada. In accordance with Order-in-Council P.C. 1964–1976 each member shall designate an alternate to serve for and in the member's absence.

In accordance with Presidential Executive Order No. 11177 the United States Section of the Permanent Engineering Board shall consist of one member designated by the Secretary of the Army who shall be Chairman of the United States Section, and one member designated by the Secretary of the Interior. In accordance with that same Order each member shall have a designated alternate to serve for and in the member's absence.

3. Chairman. The Chairman of each Section of the Board shall preside as Chairman of the Board as a whole at all meetings of the Board held in his country. In the event the Chairman of either Section of the Board is absent the chairmanship of that Section and, if appropriate, of the Board itself shall be assumed by the other member of that Section, or if that member is also absent, by the alternate to the Chairman of that Section.

4. General Duties of the Board. As set forth in the Columbia River Treaty and related documents the general duties of the Board 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 hydro-electric 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 of America at least once a year of the results being achieved under the Treaty and making special reports concerning any matter which 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 of America;

(g) consulting with the entities in the establishment and operation of a hydro-meteorological system as required by Annex A of the Treaty.

5. Meetings. The Board shall meet at such times and places as the Chairmen of the two Sections consider necessary or desirable to properly discharge the responsibilities of the Board. A quorum shall require each member of the Board to be present or represented by an alternate acting on his behalf.

6. Minutes of Board Meetings. The Chairman of each Section shall appoint a Secretary. The Secretary shall be the official recorder of the Board minutes when the Chairman of his Section is presiding. Each Secretary shall exchange and preserve an authentic copy of the minutes approved by the Board. A draft copy of the minutes will, within fifteen days after the meeting, be sent by the recording Secretary to each member of the Board for review and comments, and the comments shall be received by the Secretary within the next thirty days unless otherwise specified and agreed to by the Board. The minutes will be considered for adoption at the next Board meeting. Copies of approved minutes will be supplied to all Board members by the recording Secretary.

7. Engineering Committees. The Board may designate special Engineering Committees to assist in the performance of the Board's functions. Except as otherwise agreed by the Board, these committees will have an equal number of members from each country. The members will be qualified individuals in their respective fields and they need not necessarily be officers or employees of the Governments of the two countries. Members of the committees will be designated by the Chairman of each Section and will serve for such periods as he may determine.

8. Technical and Administrative Assistance. The respective Sections of the Board shall be provided with the technical and administrative assistance they require through:

(a) the provision of Board staff,

(b) the utilization of services available from departments or agencies of their respective Governments, and

(c) the retention of consulting engineering services.

9. Reports. As required by Article XV of the Treaty the Board will make reports to the Governments of Canada and the United States at least once a year. Reports to the Governments shall be made through the Minister of Northern Affairs and National Resources for Canada and the Secretary of State for the United States. The initial report by the Board will be submitted by December 31, 1965.

10. Expenses. Except as otherwise agreed by the Board each Government shall, in accordance with the usual budgetary practices, bear the expenses authorized by its own Section of the Board and incurred by or on behalf of that Section in carrying out its duties.

11. Communication with the Entities. Communication between the Board and the entities of the two countries will be through the offices of the respective Chairmen.

12. Rules and Regulations. The Board is empowered to make only such supplementary rules and regulations as are consistent with the procedures defined herein in order to carry out its duties and responsibilities as set forth in the Treaty.

APPENDIX D

RECORD OF FLOWS

AT THE

INTERNATIONAL BOUNDARY

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	57,500	40,400	37,400	30,100	23,300	30,300	36,400	31,800	172,000	225,000	136,000	60,900
2	56,600	42,000	38,200	24,900	24,500	31,500	31,200	41,100	184,000	221,000	134,000	52,500
3	55,400	41,600	39,400	21,600	25,900	31,400	36,700	43,300	197,000	218,000	127,000	61,200
4	52,300	37,200	38,700	22,100	27,500	31,800	29,000	45,500	204,000	216,000	128,000	66,300
5	50,300	37,200	36,400	21,100	29,700	32,600	33,700	47,300	210,000	217,000	132,000	59,500
6	53,800	39,000	35,800	19,500	29,300	33,700	29,200	48,900	216,000	220,000	138,000	49,100
7	51,400	40,700	36,900	19,800	29,200	35,800	29,300	50,800	219,000	224,000	135,000	49,400
8	53,100	40,300	40,300	21,500	27,300	39,400	27,400	52,800	222,000	227,000	125,000	60,300
9	56,000	36,500	41,800	21,900	27,500	40,500	23,700	55,000	225,000	230,000	108,000	82,300
10	57,300	34,500	42,500	21,800	27,300	40,500	28,100	57,600	228,000	232,000	95,900	80,100
11	57,800	34,000	42,700	21,700	27,300	38,000	27,100	61,400	232,000	234,000	98,600	76,000
12	65,200	34,100	41,600	23,200	27,300	34,200	26,800	64,700	237,000	235,000	106,000	79,600
13	58,100	34,000	41,800	19,600	26,900	32,200	26,000	67,800	237,000	234,000	94,000	69,500
14	54,300	34,000	36,900	18,000	26,900	31,300	33,300	72,100	242,000	233,000	91,500	72,000
15	47,400	33,600	40,400	20,200	26,300	31,200	39,100	75,800	240,000	234,000	96,700	65,700
16	44,000	34,000	43,700	19,500	25,900	32,300	38,900	79,600	236,000	233,000	98,300	79,500
17	42,700	35,500	43,700	20,000	26,100	32,300	38,900	84,600	231,000	216,000	95,500	84,000
18	44,500	36,000	43,400	20,200	25,500	32,700	38,200	90,900	226,000	185,000	90,600	84,200
19	46,700	33,700	43,600	22,700	25,500	32,800	37,700	97,400	223,000	155,000	91,100	87,000
20	47,700	31,900	43,100	23,000	24,400	33,100	36,800	104,000	222,000	141,000	90,600	84,300
21	47,600	33,200	41,100	21,200	22,000	33,300	36,200	111,000	221,000	157,000	86,100	73,200
22	46,800	33,000	31,700	23,000	23,300	28,400	24,700	119,000	221,000	146,000	87,800	64,700
23	42,100	27,300	32,500	23,400	22,600	33,600	22,800	129,000	220,000	153,000	80,200	52,000
24	40,400	26,000	32,700	21,400	25,600	33,600	24,400	138,000	219,000	150,000	62,800	41,400
25	39,600	28,200	30,100	20,400	26,700	33,500	25,300	145,000	217,000	121,000	81,700	50,000
26	39,100	29,900	28,400	20,900	30,800	33,500	24,900	151,000	216,000	130,000	93,900	48,600
27	36,500	36,900	27,400	19,600	33,900	34,800	23,900	157,000	215,000	125,000	113,000	43,900
28	40,100	43,000	25,200	19,400	28,900	35,500	23,600	162,000	220,000	120,000	118,000	52,600
29	40,000	40,200	20,200	21,300	29,200	35,100	25,200	166,000	225,000	129,000	111,000	57,300
30	36,300	39,400	21,100	25,200		35,800	26,700	169,000	227,000	143,000	91,600	61,200
31	38,600		28,000	23,600		37,400		171,000		146,000	79,000	
Mean	48,400	35,600	36,300	21,700	26,800	33,900	30,200	93,200	220,000	189,000	104,000	64,900

COLUMBIA RIVER at BIRCHBANK, B.C. — Daily discharges for the year ending 30 September 1968 in cubic feet per second.

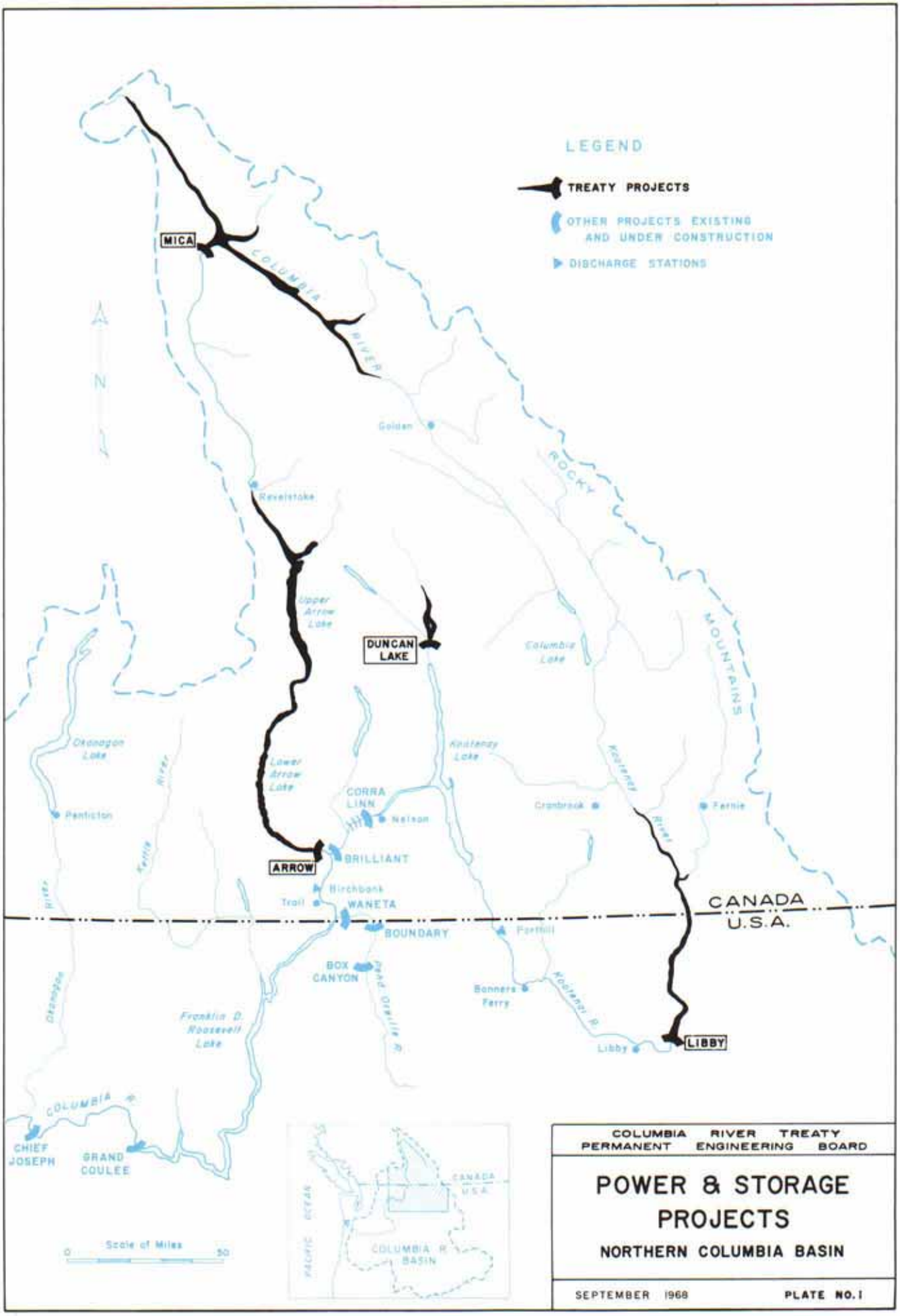
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
1	5,340	6,720	4,620	5,540	4,940	7,650	11,400	16,600	52,900	40,500	15,700	9,330
2	5,370	6,810	4,720	4,640	5,290	7,660	10,800	20,300	54,800	35,100	15,200	8,720
3	5,470	6,780	4,790	4,240	5,670	7,790	9,970	22,000	56,500	31,600	14,100	8,540
4	5,580	6,850	4,840	3,740	6,240	8,240	9,430	22,800	67,400	30,500	13,500	8,560
5	5,580	6,700	5,380	3,760	7,360	8,990	9,050	23,600	75,200	31,800	13,300	8,420
6	5,810	6,360	5,180	3,870	7,230	9,830	8,860	23,600	74,500	34,200	13,100	8,090
7	5,460	6,040	5,170	4,000	6,700	10,600	8,530	23,100	67,000	36,100	13,100	7,740
8	5,420	5,740	5,190	4,060	6,390	10,600	8,260	22,100	61,800	37,600	13,100	7,520
9	5,390	5,540	4,760	4,120	6,180	10,100	7,800	21,900	58,800	38,500	12,800	7,680
10	5,210	5,470	4,760	4,130	5,990	9,620	7,660	22,500	58,100	37,200	12,200	7,800
11	5,270	6,420	4,710	4,100	5,780	8,950	7,960	23,500	59,200	35,400	11,500	8,050
12	5,580	6,400	5,060	4,070	5,680	8,350	8,660	25,700	61,000	34,000	11,200	7,830
13	5,990	6,370	4,710	3,970	5,470	7,950	8,990	28,700	61,500	32,200	11,100	7,740
14	6,160	6,230	3,980	4,060	5,360	7,660	9,080	33,600	60,800	31,200	10,800	7,840
15	6,550	6,150	3,630	4,360	5,250	7,590	8,860	37,200	55,500	29,700	10,900	7,830
16	6,310	6,270	3,180	4,570	5,230	7,400	9,160	38,500	48,600	26,400	11,200	8,020
17	5,940	6,540	3,100	4,780	5,220	7,700	8,970	38,500	43,300	23,800	11,700	7,970
18	5,600	6,500	3,170	4,740	5,250	8,040	8,860	38,700	40,500	22,300	12,300	9,040
19	5,520	6,440	3,260	4,680	5,310	8,010	8,500	41,000	40,500	21,000	12,100	11,600
20	5,540	6,080	3,350	4,700	5,520	7,800	8,410	43,200	43,100	19,900	11,400	11,900
21	5,320	5,970	3,600	4,880	5,700	7,640	8,400	45,500	48,800	19,100	11,100	11,800
22	5,700	5,870	3,790	5,280	6,220	7,400	8,280	48,700	51,900	19,900	10,900	11,500
23	5,670	5,640	4,580	5,640	6,730	7,260	7,830	55,500	49,500	20,600	11,000	11,400
24	6,050	5,260	4,250	5,760	7,330	7,390	7,750	60,800	45,800	19,900	10,700	10,800
25	5,840	5,170	5,710	5,710	8,360	7,550	7,880	61,600	42,700	19,100	10,200	10,500
26	5,920	5,160	6,480	5,670	8,240	7,820	7,920	58,200	40,300	18,500	9,640	10,400
27	5,630	4,930	6,450	4,820	7,890	8,110	8,310	55,200	40,400	17,600	9,290	9,990
28	6,490	4,790	6,130	4,280	7,880	8,180	8,660	54,600	44,400	16,700	9,740	10,000
29	7,420	4,710	5,800	4,220	7,750	9,440	9,480	54,300	48,400	16,100	9,940	10,100
30	6,650	4,690	5,530	4,380		10,800	12,300	55,000	46,100	16,100	10,200	10,200
31	6,320		5,600	4,720		11,700		54,700		16,000	10,200	
Mean	5,810	5,950	4,710	4,560	6,280	8,510	8,870	37,800	53,300	26,700	11,700	9,230

KOOTENAI RIVER at PORTHILL, IDAHO — Daily discharges for the year ending 30 September 1968 in cubic feet per second.

APPENDIX E

LIST OF PLATES

	Plate No.
Power and Storage Projects, Northern Columbia Basin	1
Arrow Project, General Arrangement	2
Arrow Project, Earth Dam	3
Mica Project, General Arrangement	4
Mica Project, Progress Chart of Dam	5
Mica Project, Highway Relocation	6
Libby Project, General Arrangement	7
Libby Project, Reservoir Area	8

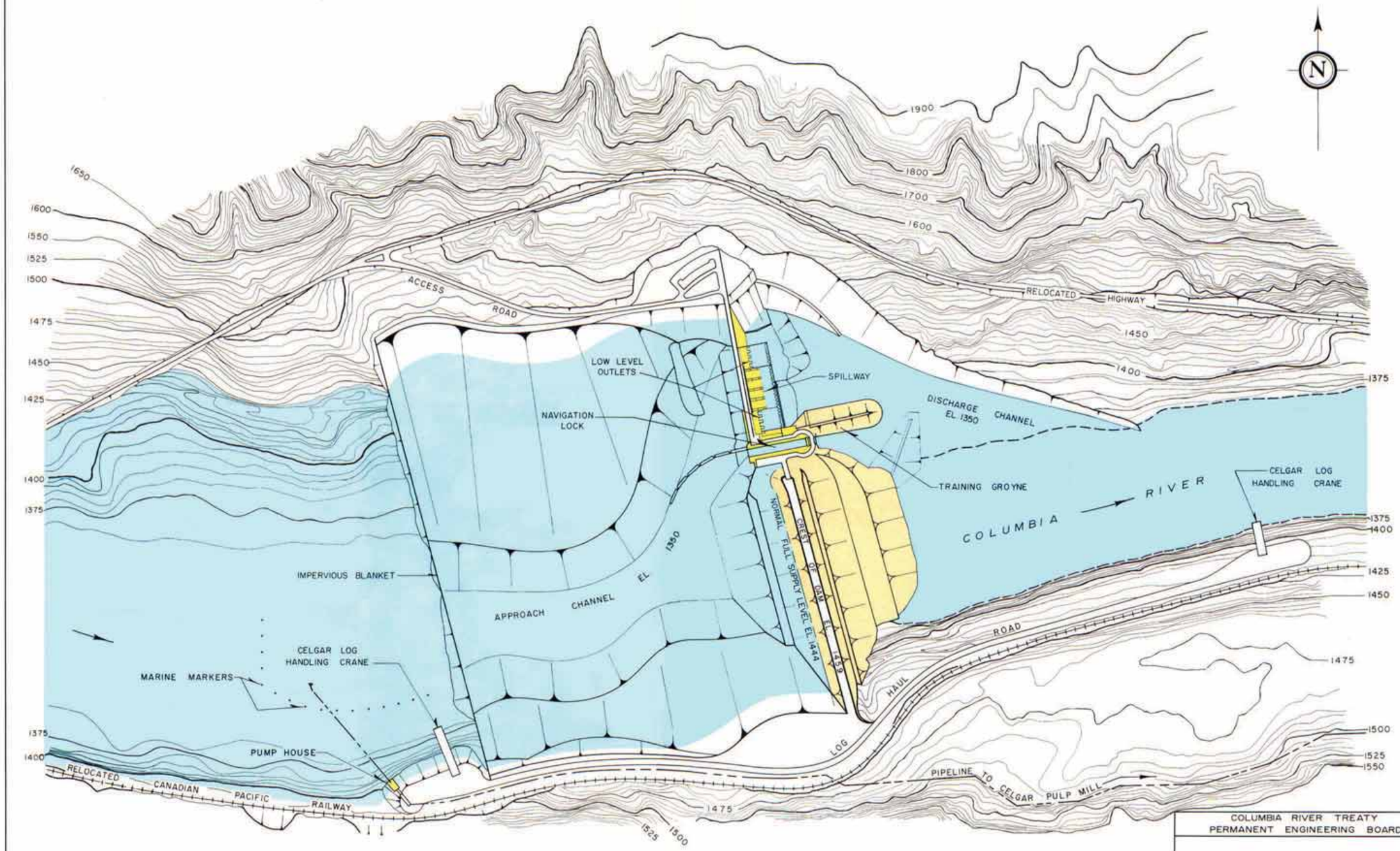


COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

POWER & STORAGE PROJECTS

NORTHERN COLUMBIA BASIN

SEPTEMBER 1968 PLATE NO. 1



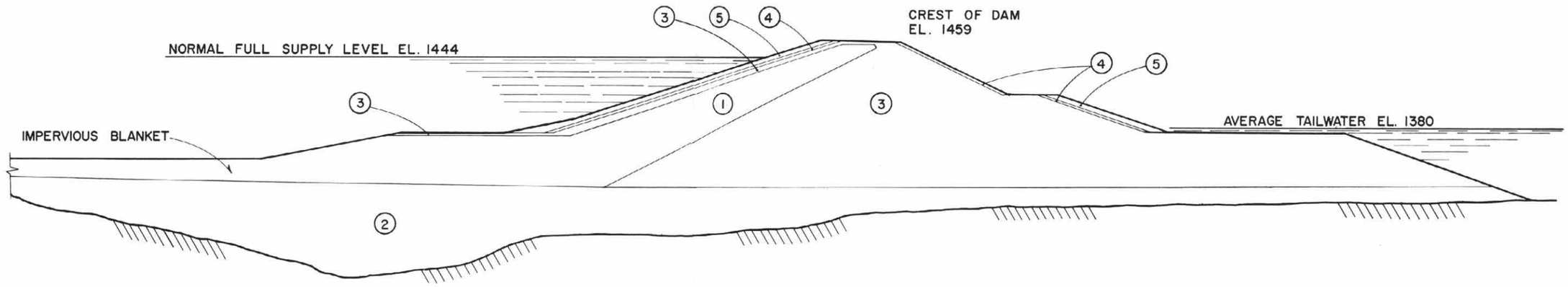
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY B.C. HYDRO & POWER AUTHORITY

COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

ARROW PROJECT

GENERAL ARRANGEMENT

SEPTEMBER 1968 PLATE NO. 2



TYPICAL SECTION OF EARTH DAM

ZONE	MATERIAL
1	IMPERVIOUS FILL
2	SAND & GRAVEL FILL
3	PERVIOUS FILL
4	RIP RAP BEDDING
5	RIP RAP

0 50 100 150 200
SCALE IN FEET

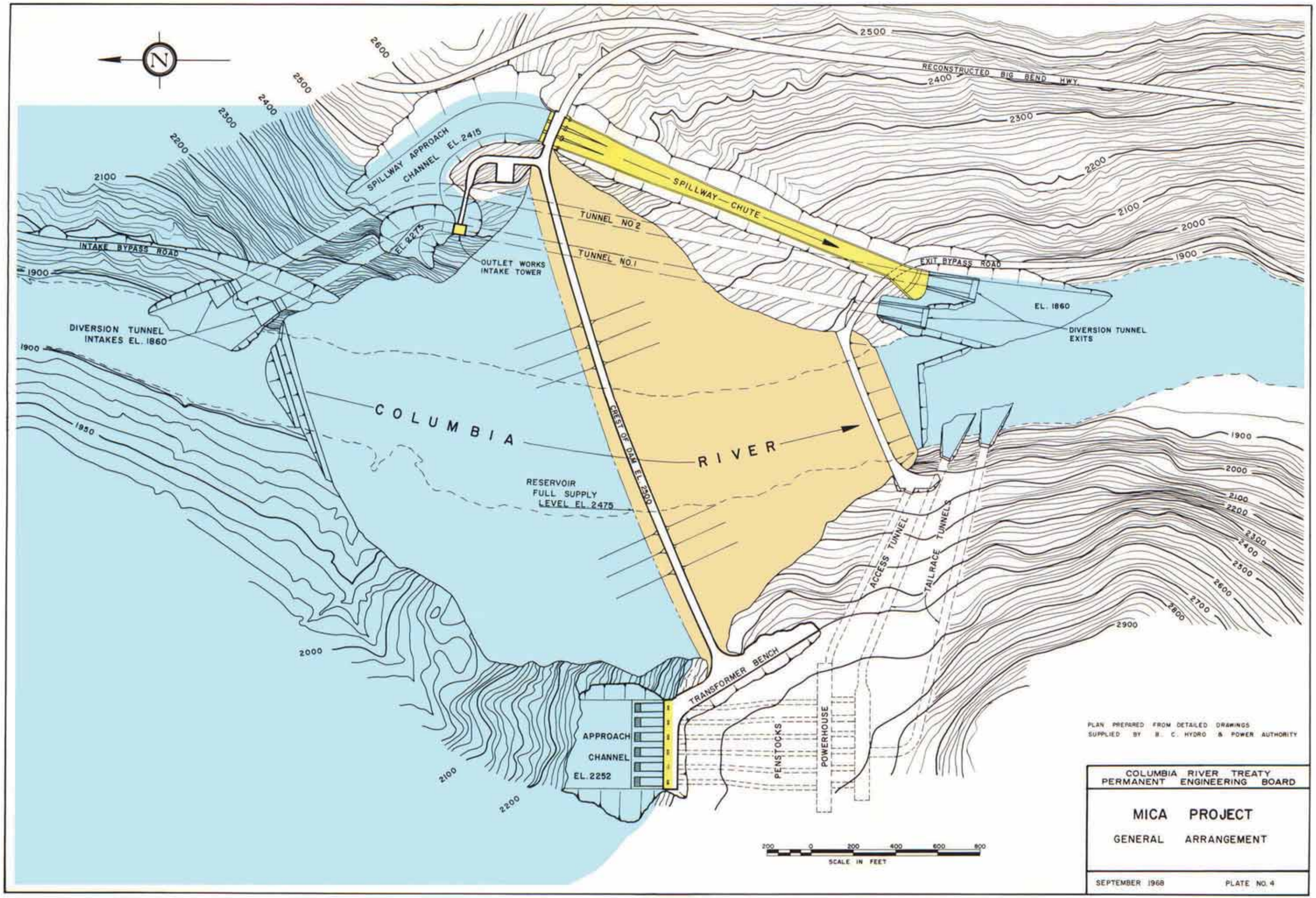
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY B.C. HYDRO & POWER AUTHORITY

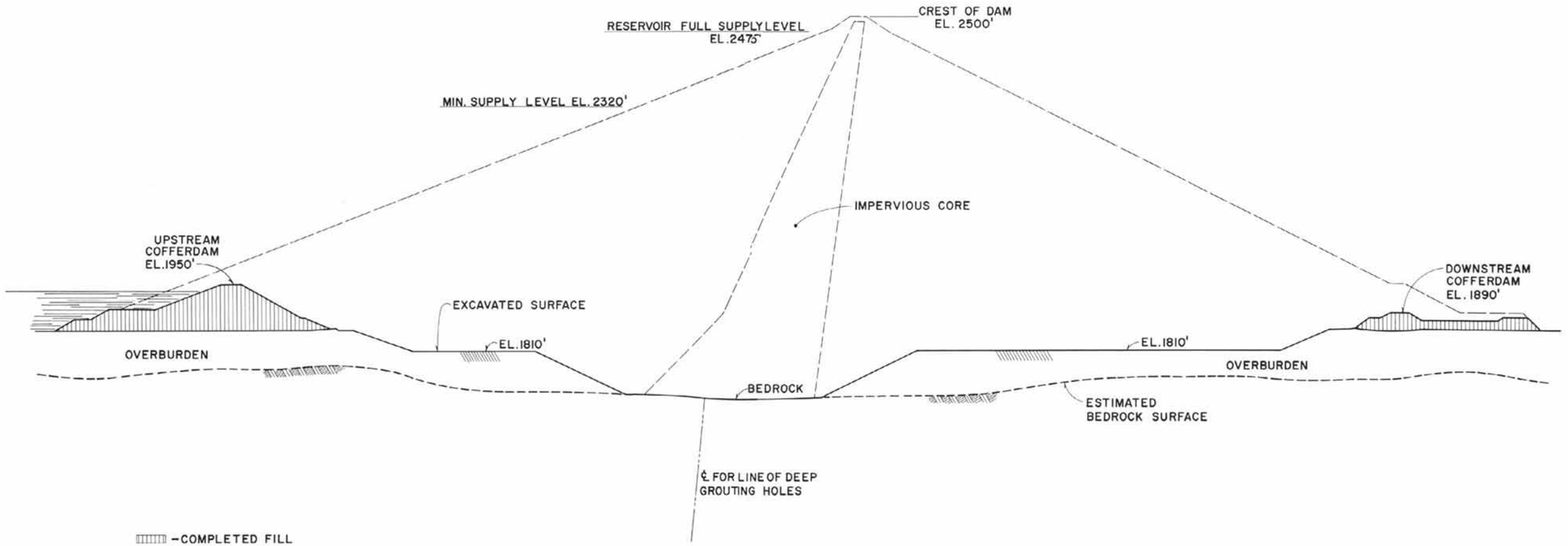
COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

ARROW PROJECT

EARTH DAM

SEPTEMBER 1968 PLATE NO. 3


N
RECONSTRUCTED BIG BEND HWY.
SPILLWAY APPROACH CHANNEL EL. 2415
SPILLWAY CHUTE
TUNNEL NO. 2
TUNNEL NO. 1
EL. 2275
OUTLET WORKS INTAKE TOWER
INTAKE BYPASS ROAD
EXIT BYPASS ROAD
EL. 1860
DIVERSION TUNNEL INTAKES EL. 1860
DIVERSION TUNNEL EXITS
COLUMBIA RIVER
RESERVOIR FULL SUPPLY LEVEL EL. 2475
CREST OF DAM EL. 2500
ACCESS TUNNEL
TAIL RACE TUNNELS
TRANSFORMER BENCH
PENSTOCKS
POWERHOUSE
APPROACH CHANNEL EL. 2252
SCALE IN FEET
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY B. C. HYDRO & POWER AUTHORITY
COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD
MICA PROJECT
GENERAL ARRANGEMENT
SEPTEMBER 1968
PLATE NO. 4



▨ – COMPLETED FILL

EXCAVATION IN RIVER BED
HAS BEEN COMPLETED

EMBANKMENT SECTION

100 0 100 200 300
SCALE IN FEET

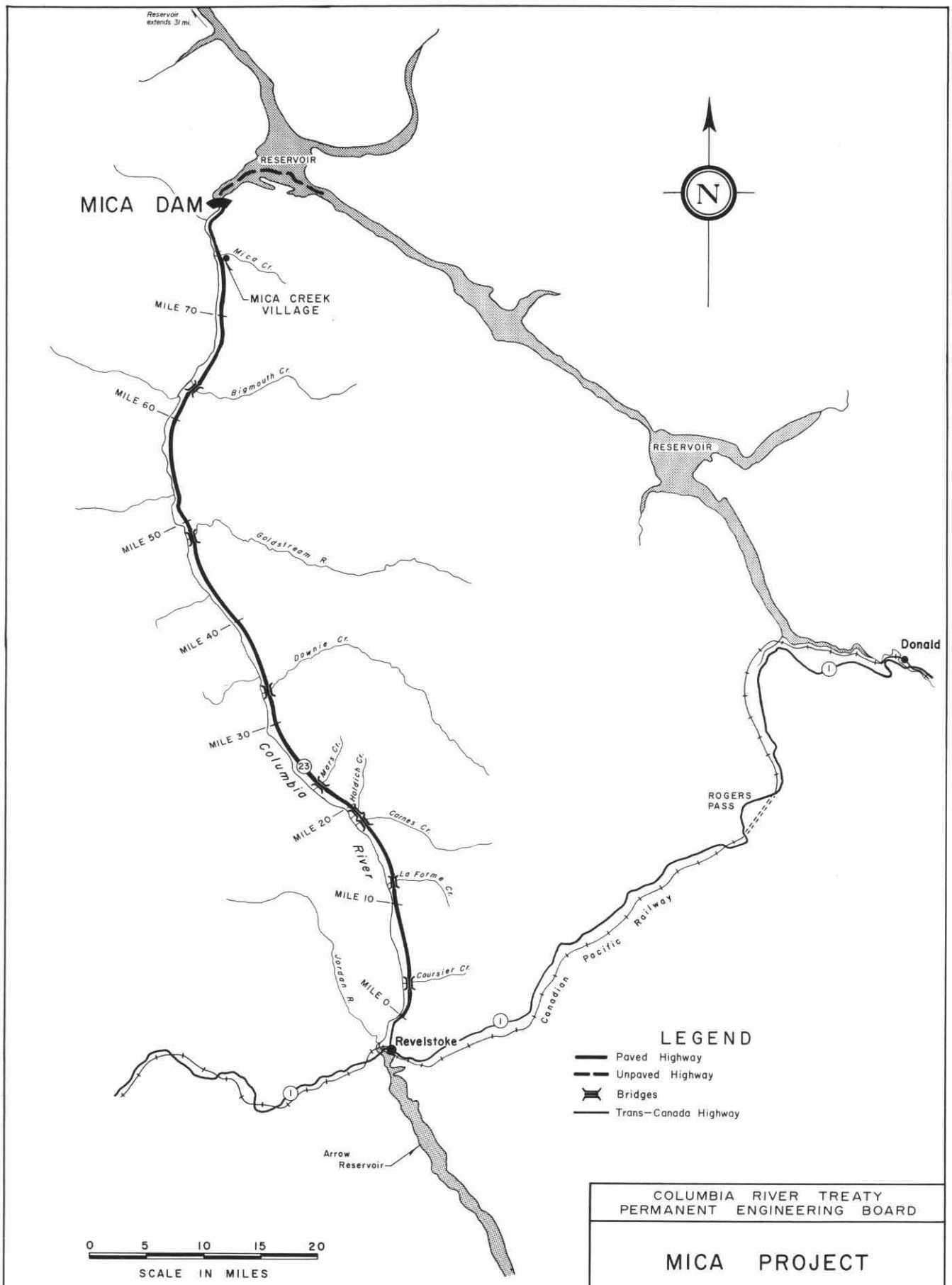
PLAN PREPARED FROM DETAILED DRAWINGS
SUPPLIED BY B.C. HYDRO & POWER AUTHORITY.

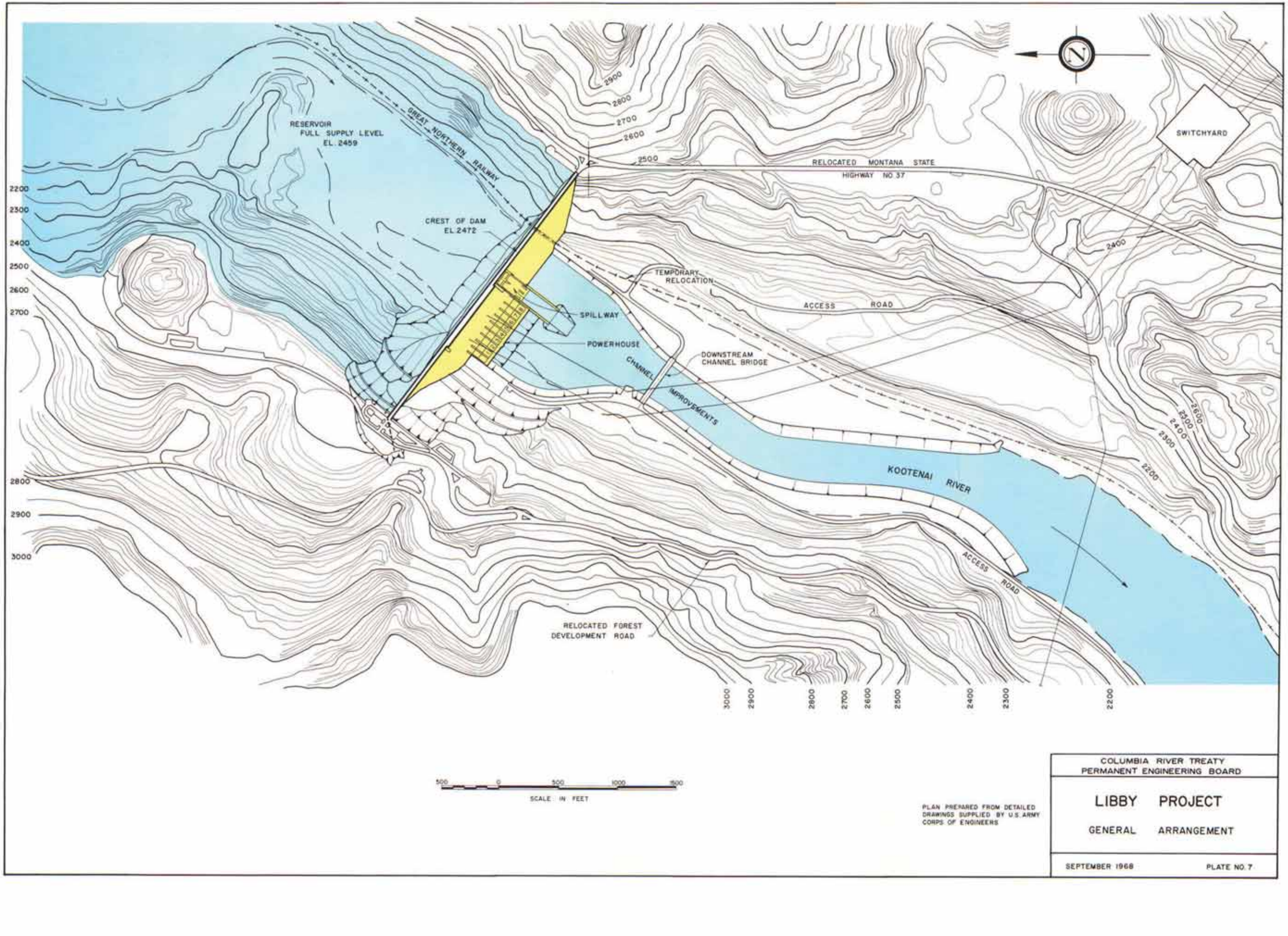
COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD

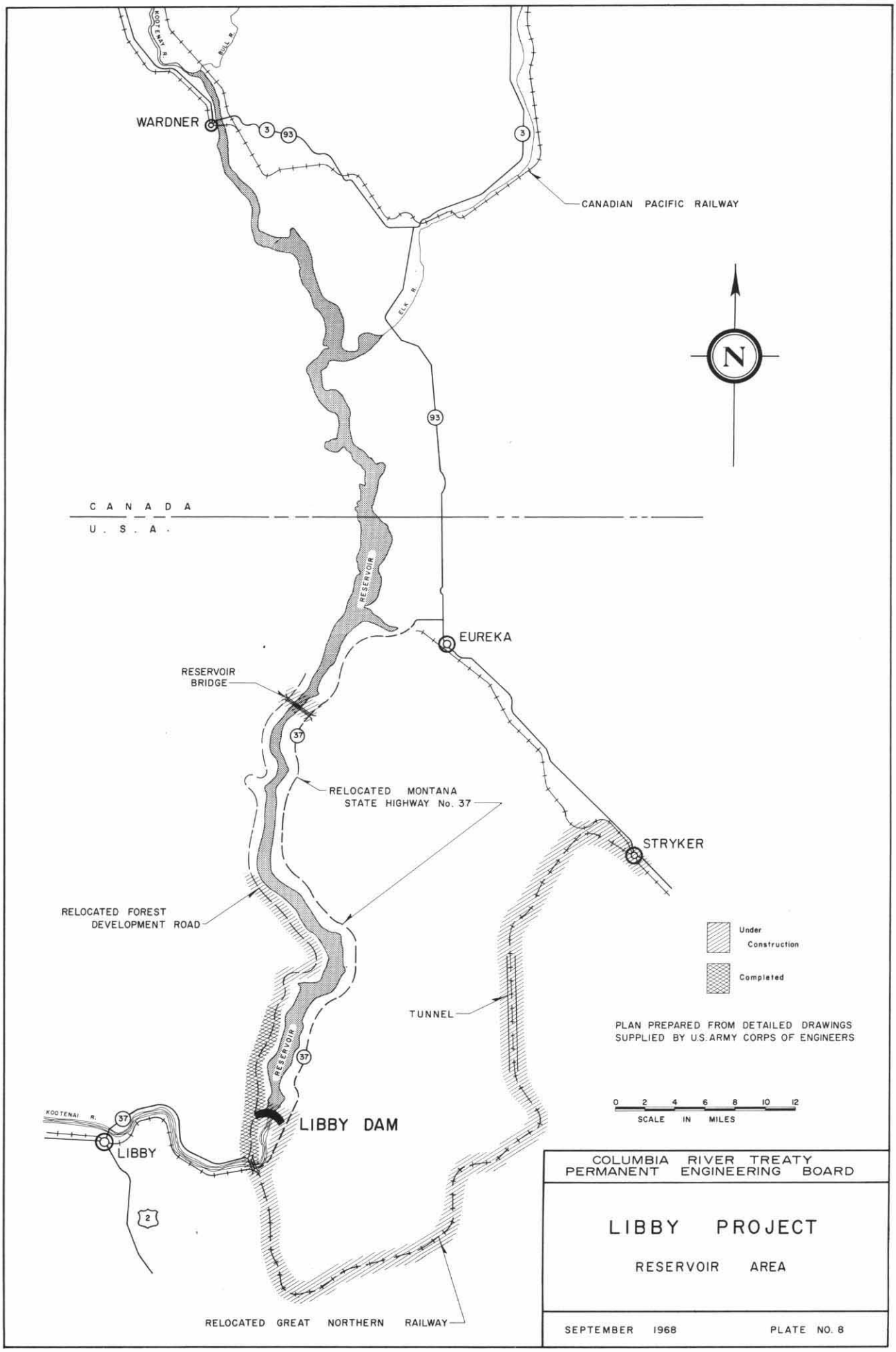
MICA PROJECT

PROGRESS CHART
OF DAM

SEPTEMBER 1968 PLATE NO. 5


Reservoir extends 31 mi.
RESERVOIR
MICA DAM
Mica Cr.
MICA CREEK VILLAGE
MILE 70
Bigmouth Cr.
MILE 60
RESERVOIR
MILE 50
Goldstream R.
MILE 40
Downie Cr.
Donald
MILE 30
Columbia
23
Mars Cr.
Holdich Cr.
ROGERS PASS
MILE 20
Carnes Cr.
River
La Forme Cr.
MILE 10
Canadian Pacific Railway
Jordan R.
Coursier Cr.
MILE 0
Revelstoke
Arrow Reservoir
N
LEGEND
Paved Highway
Unpaved Highway
Bridges
Trans-Canada Highway
0 5 10 15 20
SCALE IN MILES
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY B.C. HYDRO & POWER AUTHORITY
COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD
MICA PROJECT
HIGHWAY RELOCATION
SEPTEMBER 1968
PLATE NO. 6


RESERVOIR
FULL SUPPLY LEVEL
EL. 2459
GREAT NORTHERN RAILWAY
CREST OF DAM
EL. 2472
SPILLWAY
POWERHOUSE
TEMPORARY
RELOCATION
ACCESS ROAD
DOWNSTREAM
CHANNEL BRIDGE
CHANNEL
IMPROVEMENTS
KOOTENAI RIVER
RELOCATED MONTANA STATE
HIGHWAY NO. 37
SWITCHYARD
ACCESS ROAD
RELOCATED FOREST
DEVELOPMENT ROAD
2200
2300
2400
2500
2600
2700
2800
2900
3000
500 0 500 1000 1500
SCALE IN FEET
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS
COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD
LIBBY PROJECT
GENERAL ARRANGEMENT
SEPTEMBER 1968
PLATE NO. 7


KOOTENAI R.
BULL R.
WARDNER
3
93
CANADIAN PACIFIC RAILWAY
ELK R.
N
C A N A D A
U . S . A .
RESERVOIR
EUREKA
RESERVOIR BRIDGE
37
RELOCATED MONTANA STATE HIGHWAY No. 37
STRYKER
RELOCATED FOREST DEVELOPMENT ROAD
Under Construction
Completed
TUNNEL
PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS
0 2 4 6 8 10 12
SCALE IN MILES
KOOTENAI R.
LIBBY
LIBBY DAM
2
RELOCATED GREAT NORTHERN RAILWAY
COLUMBIA RIVER TREATY
PERMANENT ENGINEERING BOARD
LIBBY PROJECT
RESERVOIR AREA
SEPTEMBER 1968
PLATE NO. 8