

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

**COLUMBIA RIVER TREATY**  
**PERMANENT ENGINEERING BOARD**  
Washington, D.C.      Ottawa, Ontario  
**30 SEPTEMBER 1966**



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

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

UNITED STATES SECTION

W. E. JOHNSON, Chairman  
M. D. DUBROW, Member

31 December 1966

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

The Honourable Jean-Luc Pepin  
Minister of Energy, Mines and  
Resources  
Ottawa, Ontario

Gentlemen:

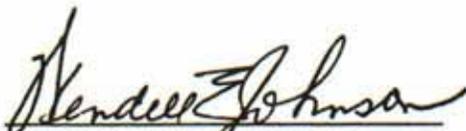
Reference is made to the Treaty between the United States of America and Canada, relating to co-operative development of the water resources of the Columbia River basin, signed at Washington, D.C. on 17 January 1961.

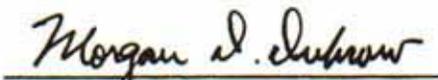
In accordance with the provisions of Article XV paragraph 2(e), there is submitted herewith the second Annual Report, dated 30 September 1966, of the Permanent Engineering Board.

The report sets forth results achieved under the Treaty for the period from 1 October 1965 to 30 September 1966.

Respectfully submitted:

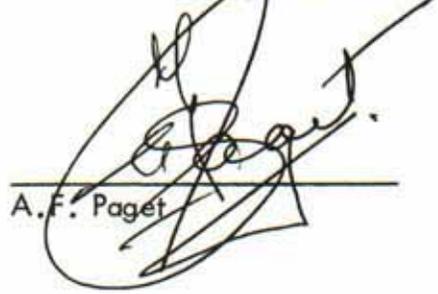
For the United States

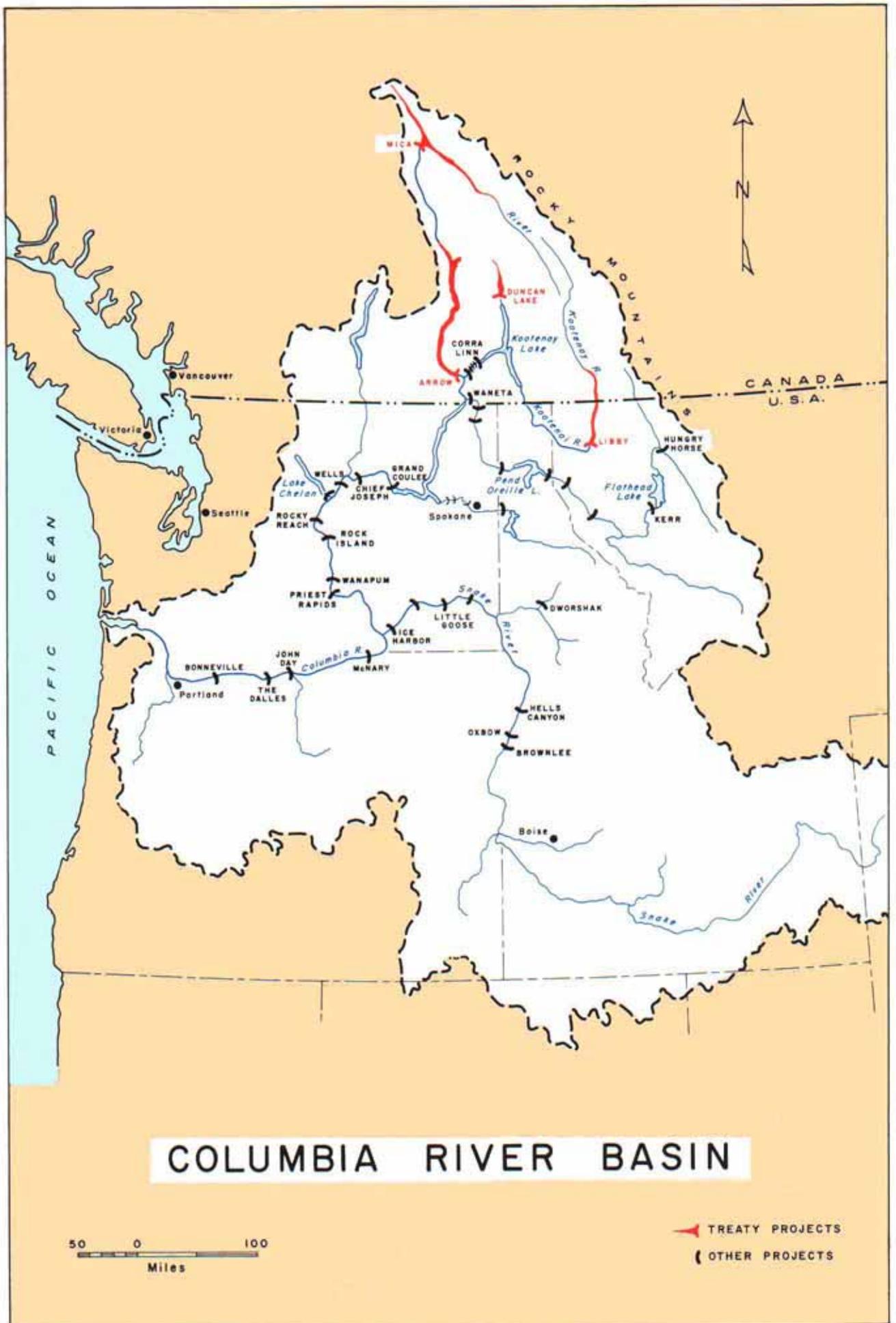
  
Wendell E. Johnson, Chairman

  
Morgan D. Dubrow

For Canada

  
G.M. MacNabb, Chairman

  
A.F. Paget



# COLUMBIA RIVER BASIN

50 0 100  
Miles

➤ TREATY PROJECTS  
( OTHER PROJECTS

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**THE UNITED STATES and CANADA**

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

**Washington, D.C.**

**Ottawa, Canada**

**30 September 1966**

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Photographs for the Duncan, Arrow and Mica Projects were supplied by the British Columbia Hydro and Power Authority.

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## SUMMARY

The second 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. Progress of project construction and studies pertaining to the Treaty are described.

The Board held three meetings during the reporting period and made an inspection of the three Canadian projects and related works during the month of August.

Substantial progress is being made at all Treaty projects. The Duncan and Arrow projects are ahead of schedule in some phases of construction. Work on the Mica project is on schedule.

Formal ground-breaking ceremonies in August marked the start of construction of Libby dam, the remaining project authorized by the Treaty provisions.

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

The Board concludes that the essential objectives of the Treaty at this time 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. The Treaty will provide each country with substantially greater benefits than if separate plans of improvement had been undertaken independently by either nation.

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...".

The initial Annual Report of the Board covered the period from the establishment of the Board on 16 September 1964 to 30 September 1965. This report, which covers the period 1 October 1965 to 30 September 1966, indicates results achieved by both countries under the terms of the Treaty and 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.

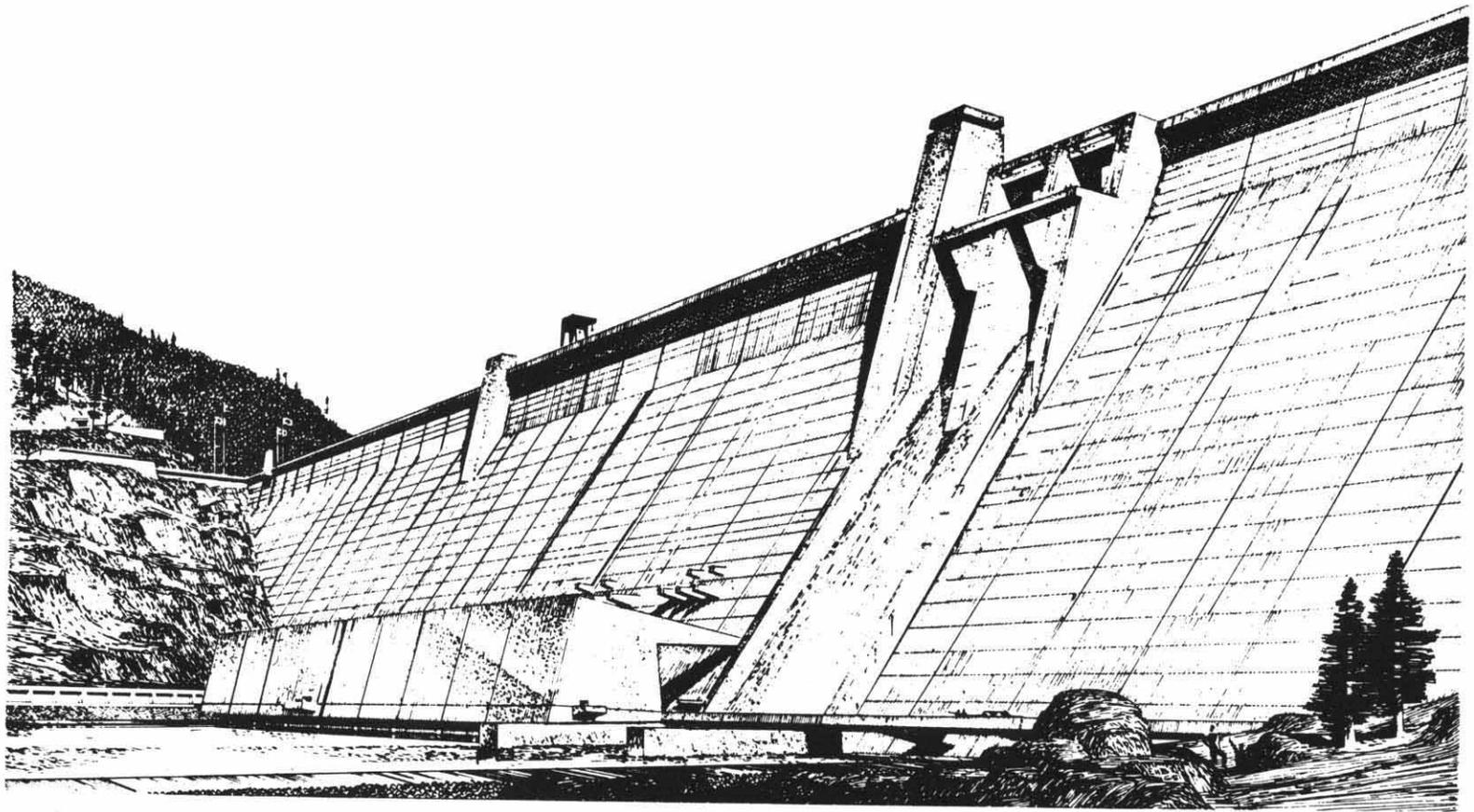
## THE COLUMBIA RIVER TREATY

### 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. A check for \$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.



LIBBY PROJECT

A perspective drawing of the dam and powerhouse.

Kootenai River, Montana

## 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



MICA PROJECT

Columbia River, British Columbia

The east abutment for the dam and diversion tunnel outlets viewed from downstream on 15 September 1966.

## 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. The Board notes with regret the untimely passing of Mr. J.T. Rothwell, Alternate Member, Canadian Section, whose death occurred in Victoria, B.C. on 10 January 1966.

## 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 hydrometeorological 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 Mines and Technical Surveys and, after 30 September 1966, will report to the Minister of Energy, Mines and Resources.

DIVERSION TUNNEL  
at the Mica Project  
being excavated to  
a diameter of about 50 feet,  
19 April 1966.



## 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. It is noted that Mr. David S. Black has succeeded the Honorable Charles F. Luce, now Undersecretary of the Department of the Interior, Washington, D.C. as Chairman of the United States Entity.



ARROW PROJECT

Columbia River, British Columbia

Concrete work inside the cofferdam on 30 September 1966 with the impervious blanket showing to the right of the cofferdam.

## 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) 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 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.

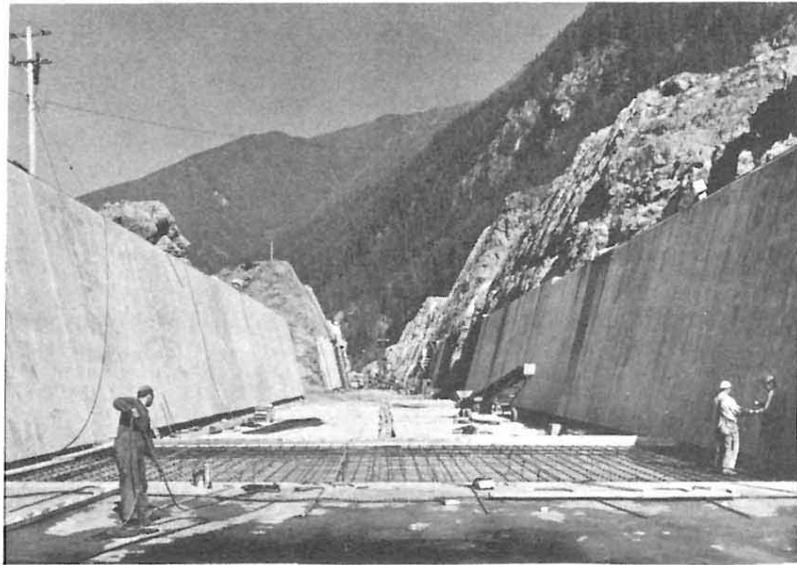
Article XIV(4) of the Treaty provides that the two governments may, by an exchange of notes, empower or charge the entities with any other matter coming within the scope of the Treaty.

## ACTIVITIES OF THE BOARD

### Meetings

The first Board meeting of the report year was held in Washington, D.C. on 23-24 November 1965 to complete the Board's first Annual Report. The second meeting was held in Victoria, B.C. on 18 April 1966 to consider progress of Entity studies. A joint meeting was held with the Entities on the following day to discuss progress. The final meeting of the report year was held in Kinnaird, B.C. on 23 August 1966 to review progress and discuss preparation of the second Annual Report.

CHUTE SPILLWAY  
at the Duncan Project  
showing concrete placed  
near the downstream end.  
13 September 1966.



### Field Inspections

On 23, 24 and 25 August 1966 the Board visited the three Canadian Treaty projects to assess construction progress.

### Reports Received

The Board continued to receive monthly reports from the Canadian Entity indicating construction progress of the Canadian Treaty projects.

Quarterly progress reports were requested and received from the Entities on their studies in the fields of the hydrometeorological network, reservoir filling plans, project discharge capacity, power operating plans and flood control operating plans. These reports also indicated progress of the Libby project.

The Entities reached agreement on the discharge capacity required for the Arrow project and in October 1965 provided the Board with the report "Arrow

Project Discharge Capacity" prepared by the Canadian Entity. The Entities also agreed on a revised discharge capacity for the Duncan project and in May 1966 supplied the Board with a new report "Supplemental Report Duncan Project Discharge Capacity", also prepared by the Canadian Entity.

The second recommendation for establishing the hydrometeorological network was received from the Entities in January 1966. This report, "Recommendation No. 2 of the Task Force on Hydrometeorological Network", summarized the first assessment of additional snow courses required by the Entities.

#### Report to Governments

The first Annual Report of the Board was submitted to the two governments on 31 December 1965.

### RESULTS ACHIEVED

#### General

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



DUNCAN PROJECT

Duncan River, British Columbia

The earthfill dam and the spillway excavation in the far abutment viewed from above the discharge tunnel outlets on 14 June 1966.

## Construction Progress of the Treaty Projects

### Duncan Project

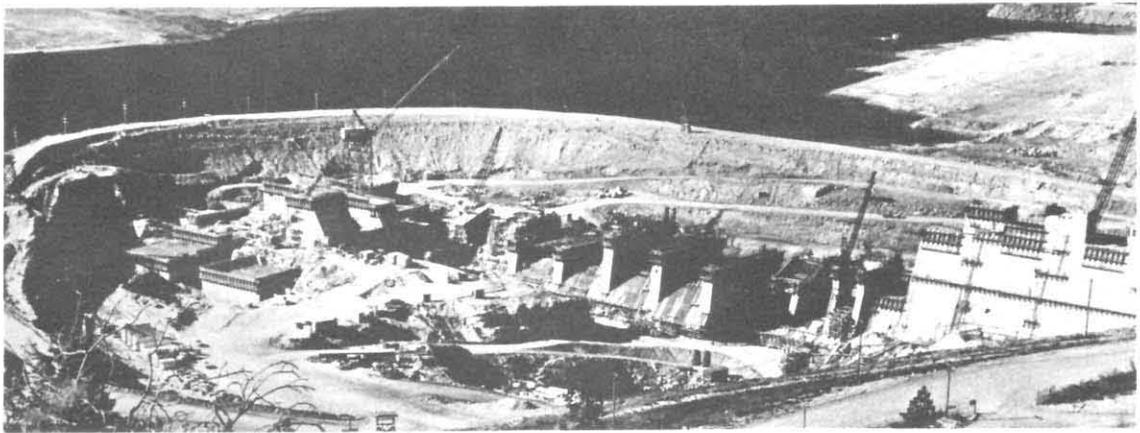
The Duncan dam, scheduled by the Sales Agreement to be operative for streamflow regulation by 1 April 1968, will be the first of the Treaty projects to be completed.

The general arrangement of structures as shown on Plate 2, includes a zoned earthfill dam built across the flat floor of the Duncan River valley between the steep valley walls. On 7 March 1966 the river channel was closed and the Duncan River diverted through the two tunnels in the right abutment. These tunnels, which will be controlled by radial gates at the downstream end, will subsequently be used to provide controlled discharges from the reservoir. Spillway facilities are located on the left abutment and will discharge through a concrete-lined spillway channel.

Progress in construction of the zoned earthfill dam, discharge works, and spillway channel is illustrated on Plate 3. Concrete construction for the discharge works and outlet channel is virtually complete and spillway construction is proceeding satisfactorily. In the reservoir area acquisition of property and clearing are proceeding.

### Arrow Project

The Arrow dam, scheduled by the Sales Agreement for operation by 1 April 1969, will be the second Treaty project to become operative for streamflow regulation.



CONCRETE WORK inside the cofferdam at the Arrow Project showing, from left to right: the navigation lock, discharge works and gravity section, 30 September 1966.

As shown on Plate 4, the Arrow project will consist of two main components. The first comprises a zoned earthfill embankment with an impervious upstream blanket across the present river channel. The second consists of the concrete gravity structures including the spillway, low-level outlets, and a navigation lock.

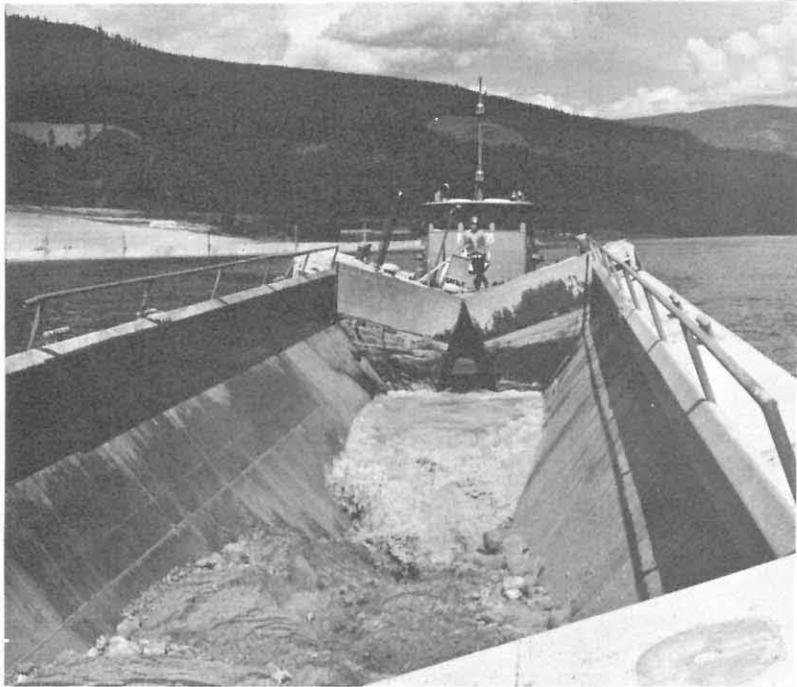
The Arrow project is proceeding very satisfactorily and well ahead of schedule. Highway and railway relocations in the vicinity of the site, local haul roads and a water supply system for the Celgar mill are complete.

Progress in construction of the earthfill dam is illustrated on Plate 5. Bottom-dump barges are being used to place fill in the river for both the main dam and impervious blanket. On the abutments, excavation for the approach and discharge channels and the placing of blanket material are well advanced.

On the north bank the cofferdam and concrete cut-off wall are complete. The concrete spillway, low-level outlets and navigation lock are under construction in the dewatered area inside the cofferdam.

Acquisition of land and relocation or dyking of certain communities upstream from the project are being undertaken to prepare the reservoir area for flooding. Road relocations and reservoir clearing also form part of this work.

BOTTOM-DUMP BARGE  
specially designed  
for placing underwater fill  
at the Arrow Project,  
8 June 1966.



### 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 6. The main dam will have a nearly vertical impervious core supported between zones of coarser material. During construction the site of the main fill will be dewatered by diverting the river through two 45-foot diameter tunnels located in the left abutment. Spillway facilities and control works to provide regulated discharges from storage will also be located in the left abutment. Present

plans propose that power facilities, when required, will be located in the right abutment as indicated on Plate 6.

Clearing has been completed at the damsite. Progress in the two 45-foot diameter diversion tunnels is shown on Plate 7. Excavation for both tunnels is essentially complete and the placing of concrete has started. Both the intake and outlet cofferdams for the tunnels are complete.

An extensive program of relocation or reconstruction of approximately 90 miles of highway has been undertaken for this project. As shown on Plate 8, the entire length of highway is under construction including the replacement of bridges. Grading of some sections is complete.

Mica Creek Village is being built to house workers during the construction period. The location of the village is shown on Plate 8.

A start has been made on land acquisition in preparation for reservoir flooding.



MICA CREEK VILLAGE  
being built six miles south  
of the Mica Project  
houses construction workers.  
School and shopping centre  
are in the middle of the area,  
15 September 1966.

## Libby Project

In accordance with the provisions in the Treaty, the United States, on 27 January 1966, exercised its option to commence construction of Libby dam on the Kootenai River near Libby, Montana. The formal notification to the Canadian Government, Appendix D, indicated that construction of the project was scheduled to commence by 30 June 1966. Thus, in accordance with Article XII of the Treaty, the outlet facilities at the dam should be fully operable by 30 June 1973.

The general arrangement of structures is shown on Plate 9, and the reservoir area and the required highway and railroad relocations are depicted on Plate 10. The concrete gravity dam will be capable of storing water up to elevation 2459 feet, and the reservoir which will have a total length of 90 miles will extend some 42 miles into British Columbia. Procurement and preparation of the land required for that portion of the reservoir in Canada will, in accordance with the terms of the Treaty, be the obligation of the Canadian Government.



LIBBY DAM SITE  
on the Kootenai River  
about 18 miles upstream from  
Libby, Montana.

The dam will consist of non-overflow monoliths, powerhouse intake and spillway monoliths. The spillway monoliths will contain two radial-type crest gates, with the outlet works being combined into the same section to utilize a common stilling basin. A roadway with 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.

Formal ground-breaking ceremonies were held at the site on 13 August 1966. Contracts have been awarded for portions of the railroad and highway relocations. Excavation work at the south and north portals for the 7-mile railroad tunnel is substantially completed. Ultimately a hundred miles of railroad and approximately the same length of Montana State Highway and Forest Development roads will have to be relocated.

#### 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 would include snow courses, precipitation stations and streamflow gauges.

As described in the Board's first Annual Report, the Entities, with the concurrence of the Board, adopted the first requirements for additional reservoir and streamflow gauges as an initial step in forming the hydrometeorological network.

Installation of the necessary improvements and new stations has been arranged by the Canadian Entity and is proceeding satisfactorily.

To improve seasonal forecasts of runoff from snowmelt for the Canadian Treaty projects the Entities, with the agreement of the Board, accepted the addition of a number of new snow courses to form part of the hydrometeorological network. Installation of these snow courses is complete. Studies of additional snow course requirements in Canada and the United States were undertaken for the Libby project.

Studies of existing meteorological stations were undertaken by the Entities with a view to selecting the first group of stations which should be added to the network.

#### Reservoir Filling

The Entities are continuing their studies of reservoir operation to establish the criteria and procedures which are necessary to ensure that the initial filling program for each of the Canadian storage reservoirs will comply with the terms of the Treaty and related documents.

Work on a program for the initial filling of Mica reservoir is continuing. Studies have been concentrated on analysis of the use of surplus energy in both countries and on the use of surcharge storage in Arrow reservoir to improve the probability of meeting the Treaty objectives in filling the Mica reservoir. Principles to be used in preparing an initial filling program are being developed.

Studies have been started on filling programs for the Duncan and Arrow reservoirs. An initial filling program for the Duncan reservoir is also being studied by the Entities.

### Power Operation

The Treaty and related documents require that before the Duncan reservoir becomes operative the Entities must agree on operating plans and downstream power benefits for each year until 1 April 1973 when all three Canadian reservoirs are scheduled to be operative. Commencing 1 April 1968 the Entities must determine annually both an assured plan of operation and the resulting downstream power benefits for the sixth succeeding year of operation.

The Entities are currently developing principles and procedures for the preparation and use of hydroelectric operating plans for the Canadian Treaty projects. The Board is awaiting a report on these studies.

### Flood Control Operating Plans

The terms of the Treaty provide 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 year, work continued on computer studies of flood routing for an analysis of major floods of record in the Columbia River basin to derive and check preliminary flood control operating rules. A computer program was established for routing flows through the Arrow Lakes. The 1948 and 1961 floods were

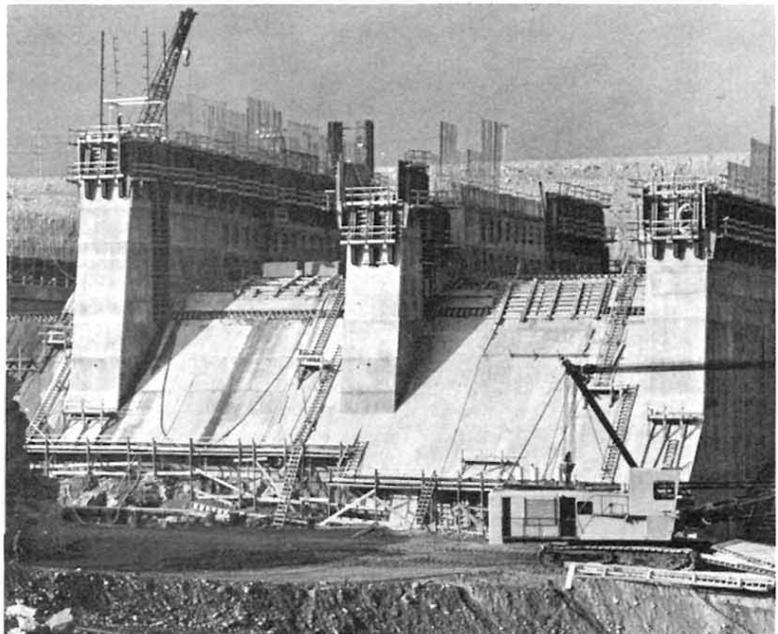
routed through the Duncan and Arrow projects to determine the degree of flood regulation afforded at potential Canadian flood areas, with particular attention to the Columbia River at Trail, B.C. The technical requirements and operating criteria for flood regulation of the Columbia River basin are being reviewed for projects in Canada and the United States.

The Board is awaiting a report from the Entities on flood control operating plans for the Treaty projects.

### 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.

SPILLWAY  
at the Arrow Project  
taking shape;  
a view of the downstream face  
of the northern two openings,  
23 September 1966.



The Canadian Entity has prepared a detailed discharge capacity report for the Arrow project and a revised report for the Duncan project. The Entities have reached agreement on both of these reports and copies of the reports and of the signed agreements have been received by the Permanent Engineering Board. The Entities agree that the reported discharge capacities are adequate to provide the desired regulation for flood control and power operation.

For the Duncan project, studies regarding flow control and instrumentation and minimum project discharge are progressing.

Work has started on a study of discharge facilities for the Mica project.

#### 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.

Flows at points where the Columbia and Kootenay Rivers cross the International Boundary are currently obtained as part of a cooperative arrangement between the United States and Canadian Governments. The Board therefore in its first Annual Report concluded that the collection of additional data is not required. It also concluded that once the first Treaty project becomes operative flows as regulated by the Treaty projects will be recorded and flows which would have occurred at the International Boundary under pre-project conditions will be determined.

## CONCLUSIONS

1. Construction progress at all Treaty projects is proceeding on schedule, and in some instances is well ahead of schedule.
2. Entity studies on project discharge capacities and the hydrometeorological network are proceeding satisfactorily.
3. The Entities are carrying out studies in the fields of reservoir filling and power and flood control operation. The Board has requested reports from the Entities on these matters.
4. Finally, the Board concludes that the essential objectives of the Treaty at this time are being met.

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

United States

Members

Canada

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  
Senior Engineer,  
Water Resources Branch,  
Department of Mines and Technical  
Surveys,  
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  
Engineer, Planning Division,  
Civil Works Directorate,  
Office, Chief of Engineers,  
U.S. Army,  
Washington, D.C.

Mr. E.M. Clark  
Engineer, Water Resources Branch,  
Department of Mines and Technical  
Surveys,  
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 (1)  
Chief, Power and Major Licences  
Division,  
Water Rights Branch,  
Water Resources Service,  
Department of Lands, Forests, and  
Water Resources,  
Victoria, B.C.

Secretaries (2)

Mr. John W. Roche  
Engineer, Planning Division,  
Civil Works Directorate,  
Office, Chief of Engineers,  
U.S. Army,  
Washington, D.C.

Mr. E.M. Clark  
Engineer, Water Resources Branch,  
Department of Mines and Technical  
Surveys,  
Vancouver, B.C.

(1) Vice Mr. J.T. Rothwell, deceased on 10 January 1966.

(2) Appointed by the Board at its initial meeting held in Vancouver, B.C.,  
14-15 January 1965.

ENTITIES  
COLUMBIA RIVER TREATY

United States

Canada

Mr. David S. Black, Chairman (1)  
Administrator, Bonneville Power  
Administration,  
Department of the Interior,  
Portland, Oregon

Dr. H. L. Keenleyside, Chairman  
Co-chairman, British Columbia  
Hydro and Power Authority,  
Vancouver, B.C.

Brigadier General Peter C. Hyzer  
Division Engineer, North Pacific  
Division,  
Corps of Engineers, U.S. Army,  
Portland, Oregon

(1) Vice the Honorable Charles F. Luce, Undersecretary of the Department of the Interior, Washington, D.C. as of 13 September 1966.

ADMINISTRATION AND PROCEDURES

COLUMBIA RIVER TREATY  
PERMANENT ENGINEERING BOARD

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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 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.

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.

EXCHANGE OF NOTES  
RELATING TO LIBBY

Ottawa, January 27, 1966

No. 286

Sir:

I have the honor to refer to the Treaty between Canada and the United States of America relating to cooperative development of the water resources of the Columbia River Basin, signed at Washington on January 17, 1961, the respective instruments of ratification of which were exchanged at Ottawa on September 16, 1964.

I have been directed by the Secretary of State to inform you that by this Note the United States of America exercises its option to commence construction of a dam on the Kootenai River near Libby, Montana, known as the Libby Dam Project, as provided for in Article XII, Kootenai River Development, of the Treaty. There is enclosed the schedule of construction of the Libby Dam Project.

The planning and construction of the Libby Dam Project has been assigned to the Corps of Engineers, Department of the Army. The work will be accomplished by the Seattle District Engineer of the Corps of Engineers, North Pacific Division, Corps of Engineers.

In the interest of facilitating necessary field liaison, may I be advised of the authority in Canada with which the field offices of the Corps of Engineers may consult in connection with detailed matters relating to the planning and construction of the Libby Dam Project.

I await your Note in reply including your concurrence or suggested revisions.

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

"W. Walton Butterworth"

Ambassador

Enclosure:

Schedule of Construction  
of Libby Dam Project

The Honorable

Paul Martin, P.C., Q.C.,

Secretary of State

for External Affairs,

Ottawa

## Schedule of Construction

### Libby Dam Project

#### Commencement of Construction

Construction will commence by June 30, 1966, except that commencement of construction may be delayed until, but not later than, June 30, 1967 provided that:

a. The delay is not wilful or reasonably avoidable as determined by the United States of America; and

b. The United States of America notifies the Government of Canada by June 30, 1966, of the occurrence of such delay. If the commencement of construction is to be delayed, the delayed commencement date shall be communicated by written notice to the Government of Canada as soon as that date has been determined.

#### Operation of Storage

Initial closure will be completed within six years after June 30, 1966, or the delayed commencement date as the case may be. The dam will have the capacity of storing water up to elevation 2459, with the outlet facilities fully operable within seven years from June 30, 1966, or the delayed commencement date as the case may be, it being understood that such delayed date will not in any event be postponed beyond June 30, 1967.

Ottawa, January 27, 1966

No. L-30

Excellency,

I have the honour to refer to your Note No. 286 of January 27, 1966, by which you have advised me that the United States of America has exercised its option to commence construction of a dam on the Kootenai River near Libby, Montana, known as the Libby Dam Project, as provided for in Article XII of the Treaty between Canada and the United States of America relating to cooperative development of the water resources of the Columbia River Basin for which the respective instruments of ratification were exchanged at Ottawa on 16 September 1964.

Now that the option to construct the Libby Dam Project has been exercised I wish to advise you that the Government of Canada shall, in accordance with Article XII of the Treaty, prepare and make available for flooding the land in Canada necessary for the reservoir of the dam within a period consistent with the construction schedule attached to your Note.

I observe from your Note that the planning and construction of the Libby Dam Project has been assigned to the Corps of Engineers, Department of the Army, and that the work will be accomplished by the Seattle District Engineer of the North Pacific Division, Corps of Engineers.

I further observe that in recognition of the fact that field liaison and coordination may be required between the United States and Canadian authorities

immediately concerned with the Libby Dam Project, you have designated the Corps of Engineers, Department of the Army as the United States authority through which such consultations in connection with detailed matters relating to the planning and construction of the Libby Dam Project should be channelled.

In response to your request that you be advised of a corresponding authority in Canada, I wish to advise you that no such specific designation has yet been made and, that, until further notice, consultations of the kind referred to by your Note should be carried out through the Deputy Minister Water Resources, for the Province of British Columbia Department of Lands, Forests and Water Resources.

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

"Paul Martin"

Secretary of State  
for External Affairs

His Excellency

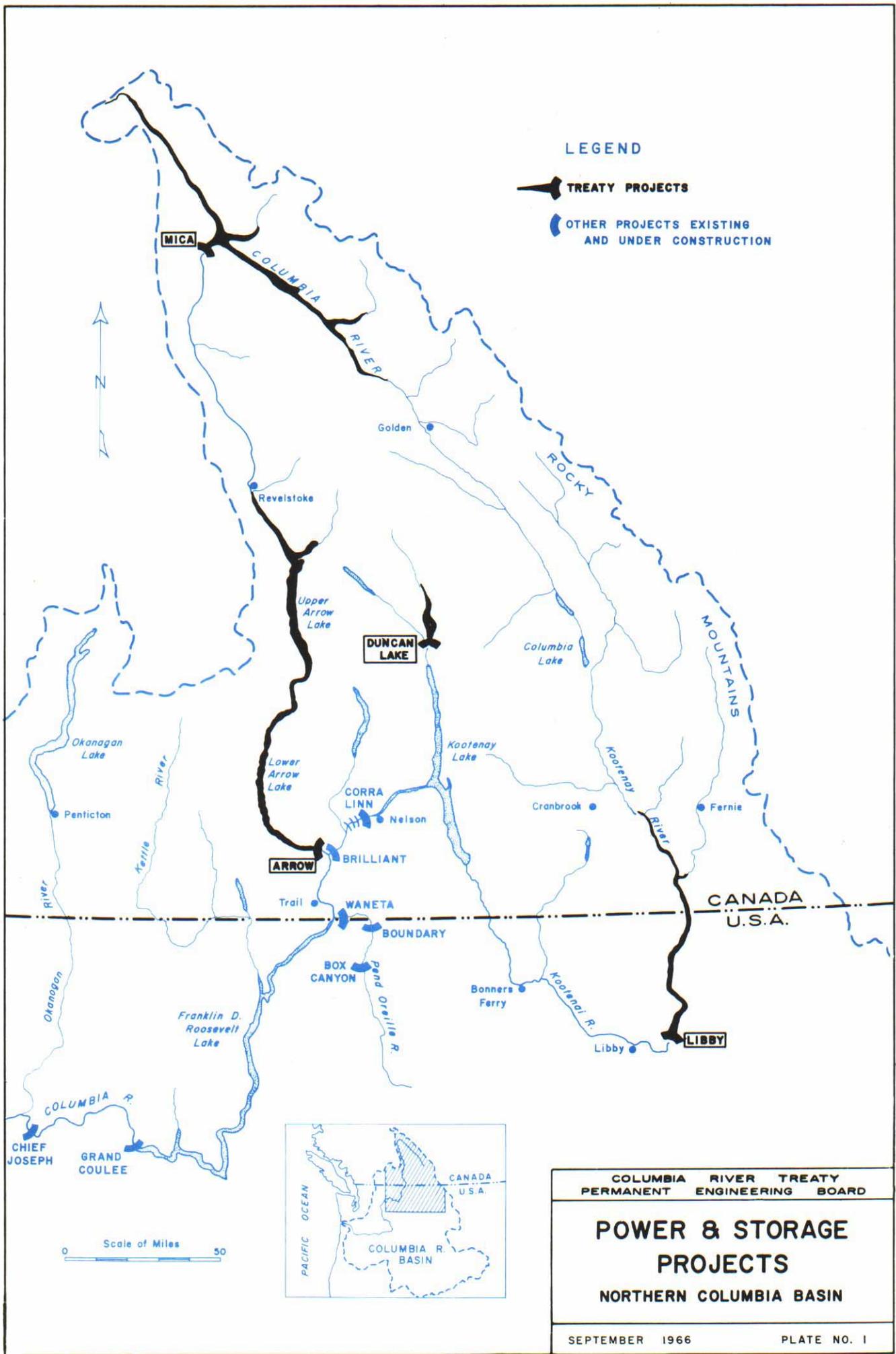
W. Walton Butterworth

Ambassador of the United States of America

Ottawa

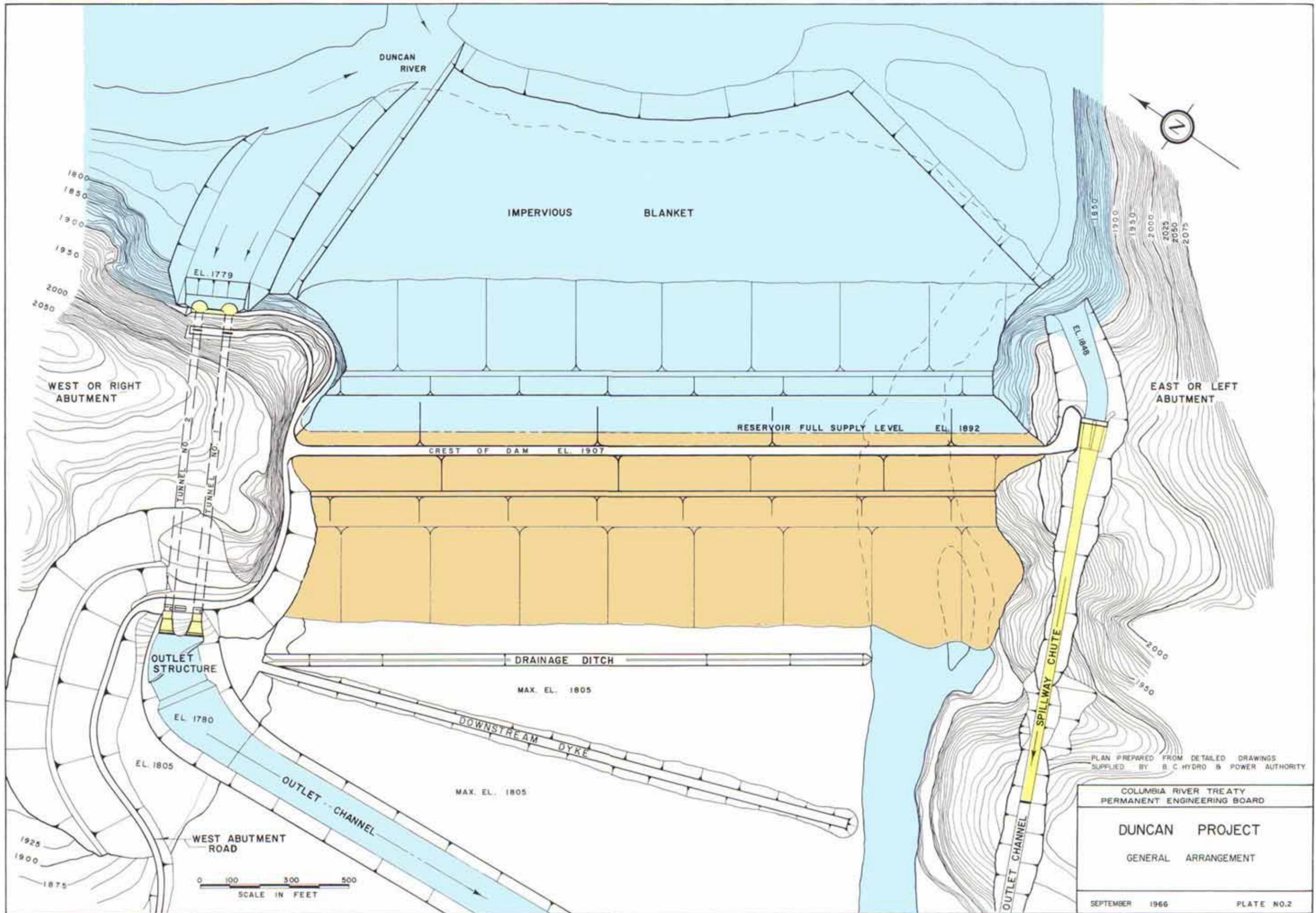
LIST OF PLATES

	<u>Plate No.</u>
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Arrow Project, Progress Chart of Earth Dam	5
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Mica Project, Progress Chart of Diversion Tunnels	7
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Libby Project, General Arrangement	9
Libby Project, Reservoir Area	10



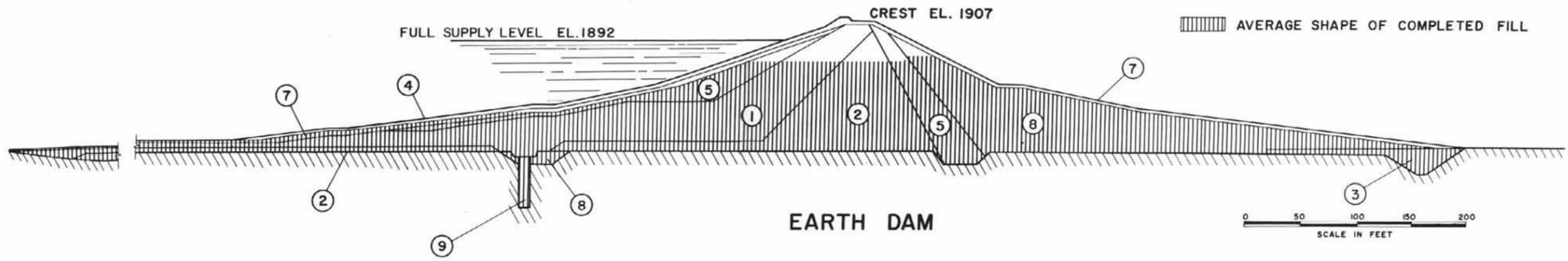
COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD

**POWER & STORAGE PROJECTS**  
**NORTHERN COLUMBIA BASIN**

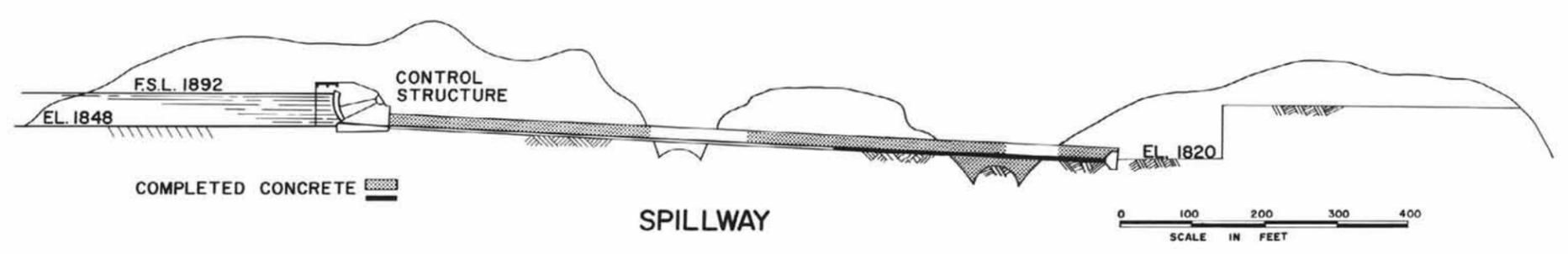
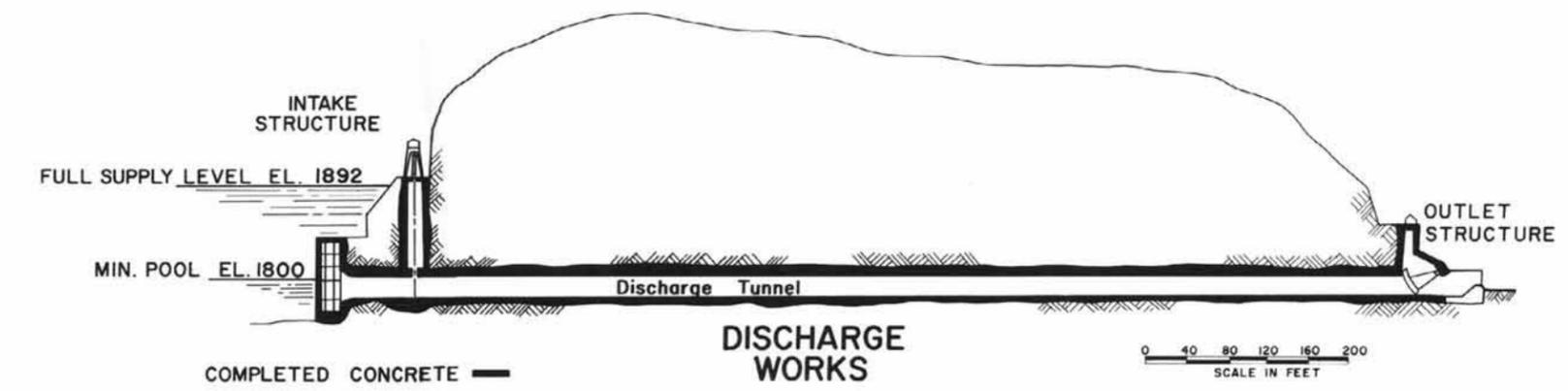


PLAN PREPARED FROM DETAILED DRAWINGS  
 SUPPLIED BY B. C. HYDRO & POWER AUTHORITY

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD	
<b>DUNCAN PROJECT</b>	
GENERAL ARRANGEMENT	
SEPTEMBER 1966	PLATE NO.2



ZONE	MATERIAL
1	IMPERVIOUS FILL
2	SEMI PERVIOUS FILL
3	PROCESSED FILTER
4	RIP RAP
5-8	PERVIOUS FILL VARIOUS GRADINGS
9	IMPERVIOUS CUT-OFF WALL

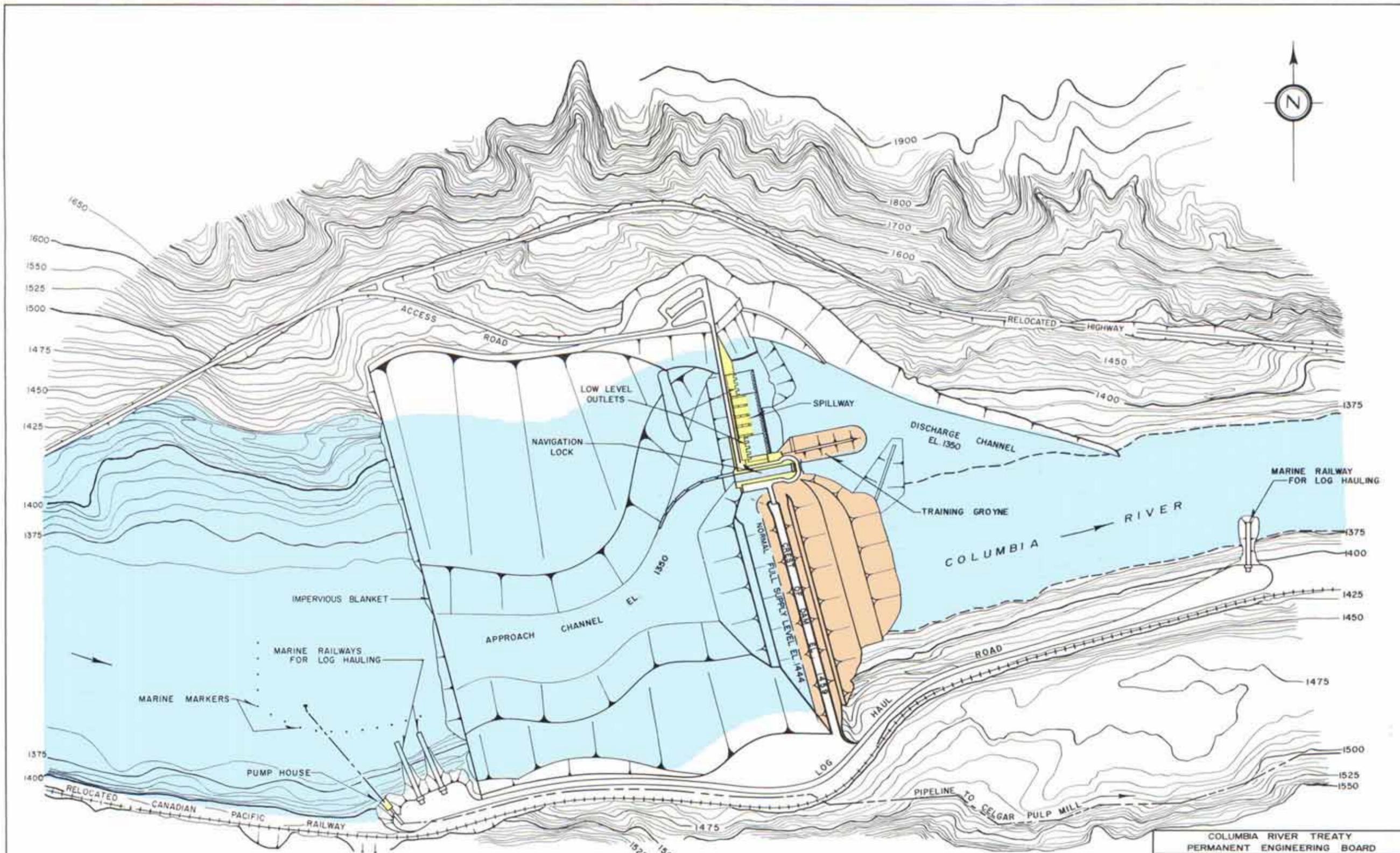


PLAN PREPARED FROM DETAILED DRAWINGS  
SUPPLIED BY B.C. HYDRO & POWER AUTHORITY

COLUMBIA RIVER TREATY  
PERMANENT ENGINEERING BOARD

**DUNCAN PROJECT**  
PROGRESS CHARTS  
OF SPILLWAY  
DISCHARGE WORKS & EARTH DAM

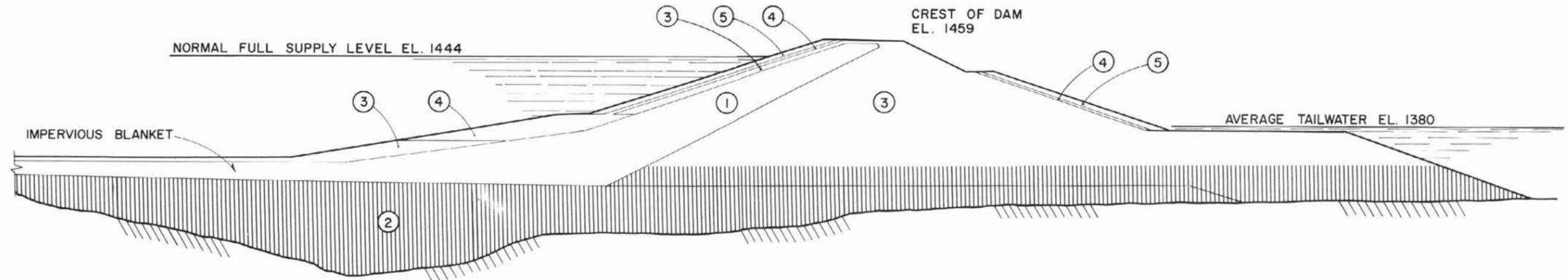
SEPTEMBER 1966      PLATE NO. 3



200 0 200 800  
SCALE IN FEET

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

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD	
<b>ARROW PROJECT</b>	
GENERAL ARRANGEMENT	
SEPTEMBER 1966	PLATE NO. 4



TYPICAL SECTION  
OF  
EARTH DAM

▨ AVERAGE SHAPE OF COMPLETED FILL

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



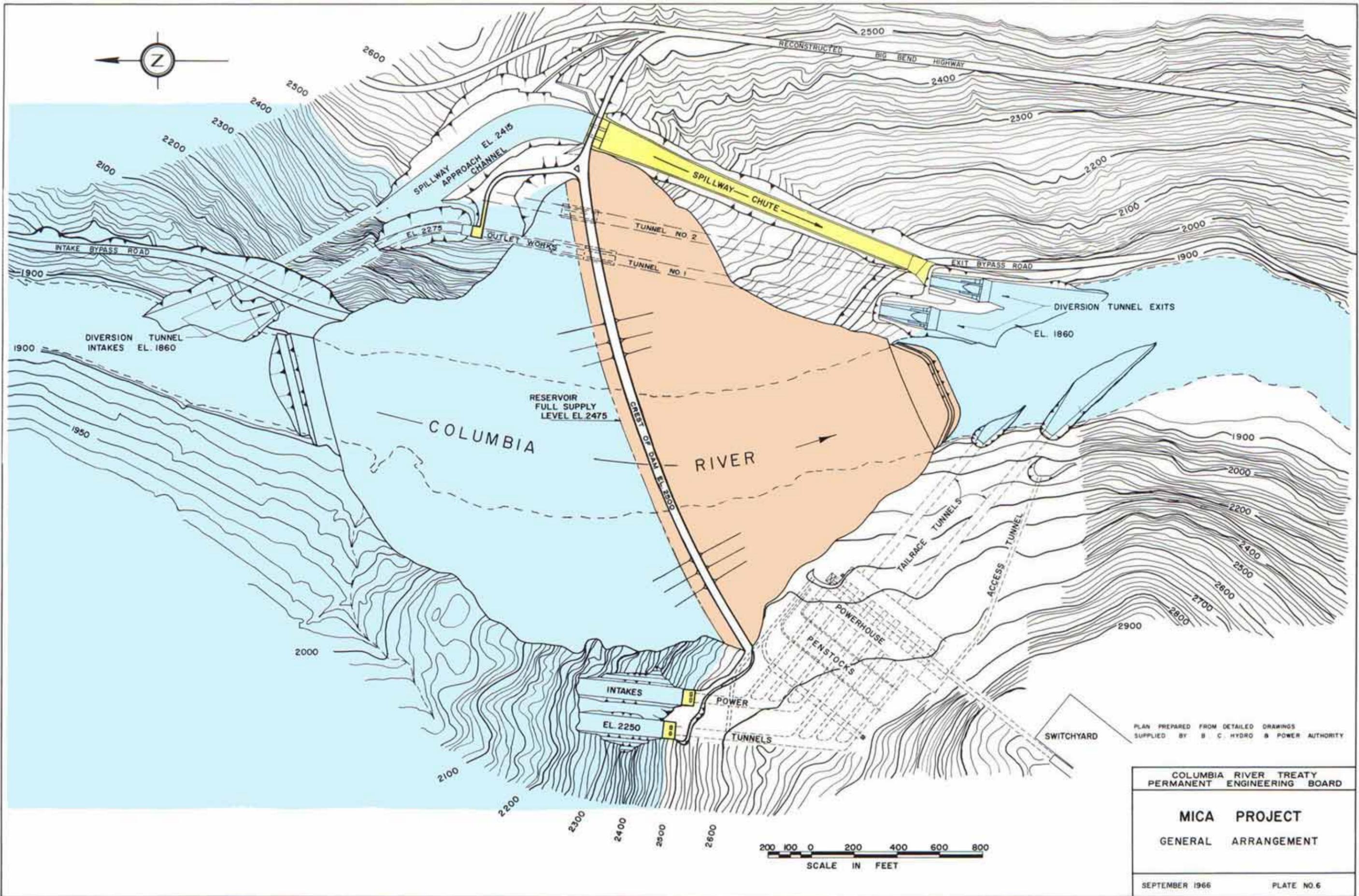
PLAN PREPARED FROM DETAILED DRAWINGS  
SUPPLIED BY B.C. HYDRO & POWER AUTHORITY

COLUMBIA RIVER TREATY  
PERMANENT ENGINEERING BOARD

ARROW PROJECT  
PROGRESS CHART  
OF  
EARTH DAM

SEPTEMBER 1966

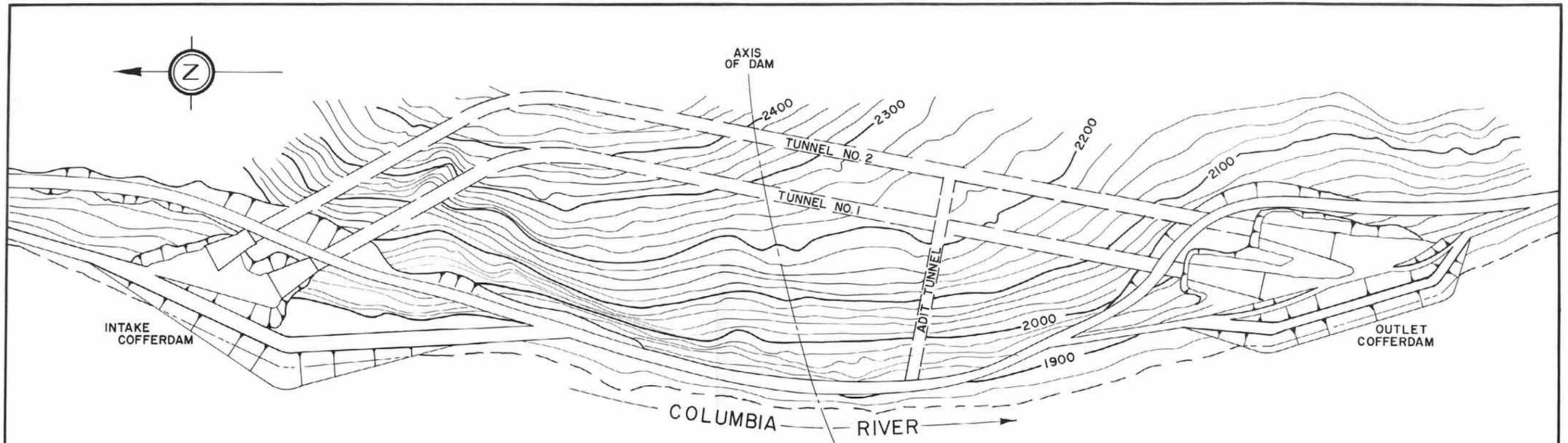
PLATE NO. 5



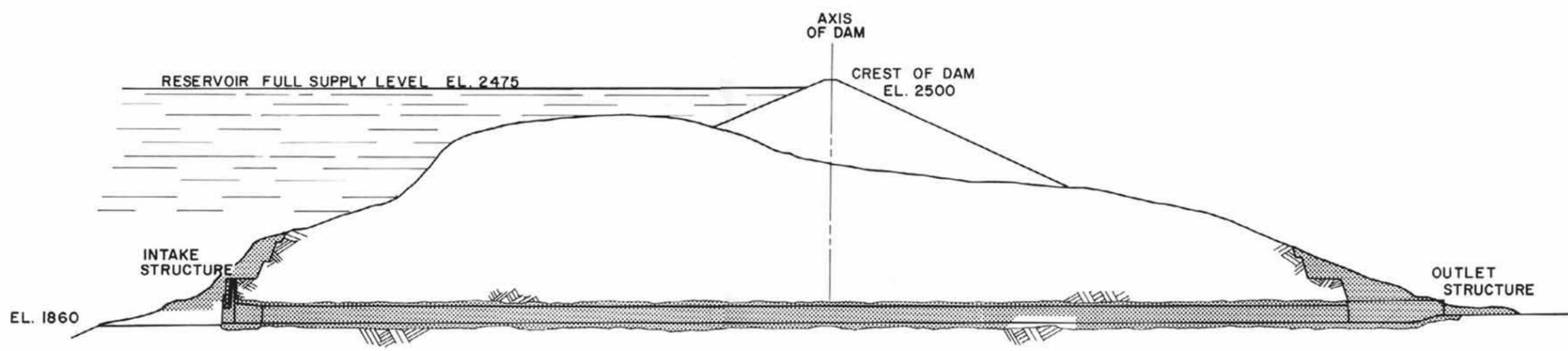
PLAN PREPARED FROM DETAILED DRAWINGS  
 SUPPLIED BY B. C. HYDRO & POWER AUTHORITY

COLUMBIA RIVER TREATY  
 PERMANENT ENGINEERING BOARD

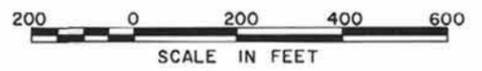
**MICA PROJECT**  
 GENERAL ARRANGEMENT



PLAN OF DIVERSION TUNNELS  
EXCAVATION AND COFFERDAMS

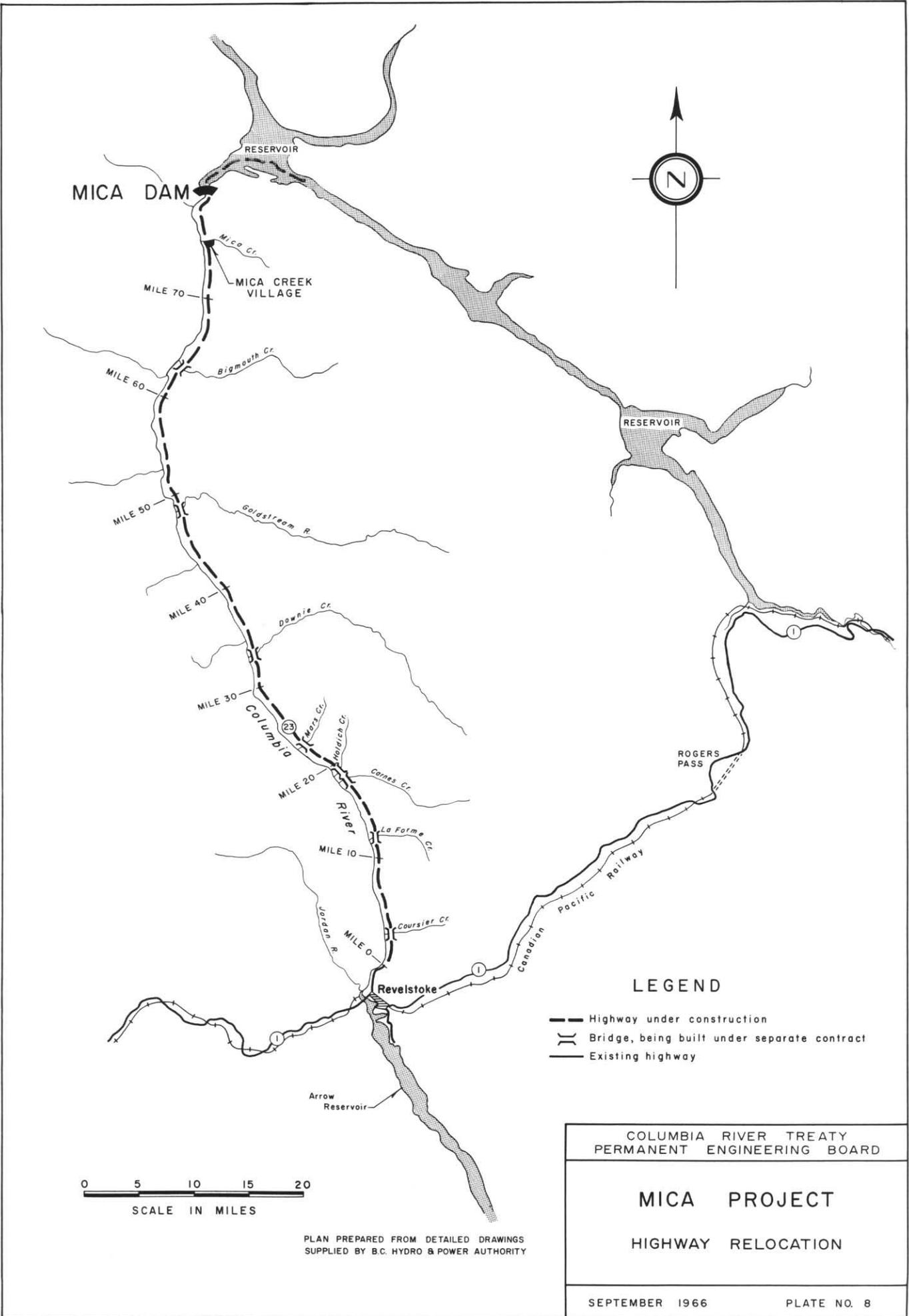


TYPICAL TUNNEL SECTION  
 COMPLETED EXCAVATION



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

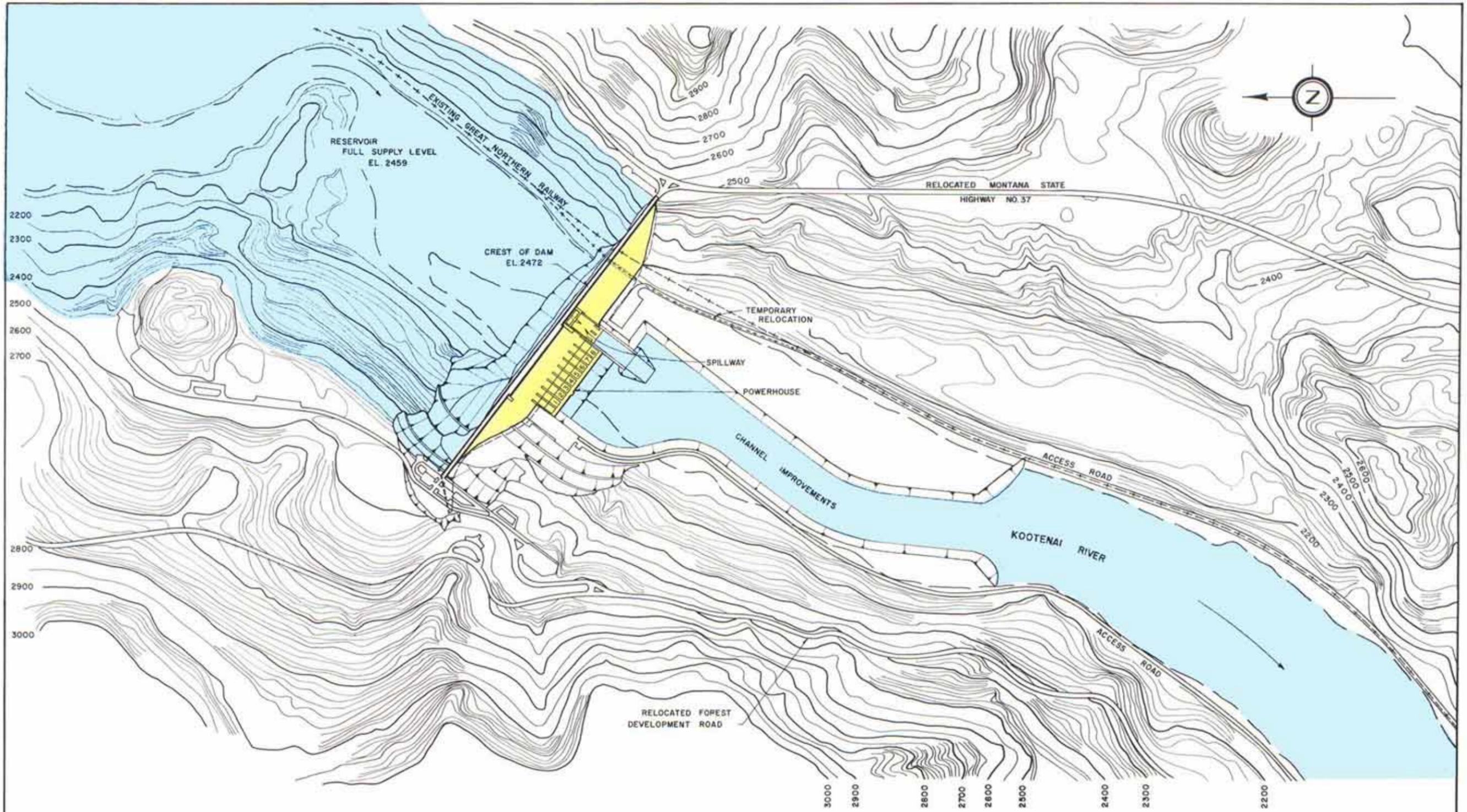
COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD	
<b>MICA PROJECT</b>	
DIVERSION TUNNELS	
SEPTEMBER 1966	PLATE NO.7



COLUMBIA RIVER TREATY  
PERMANENT ENGINEERING BOARD

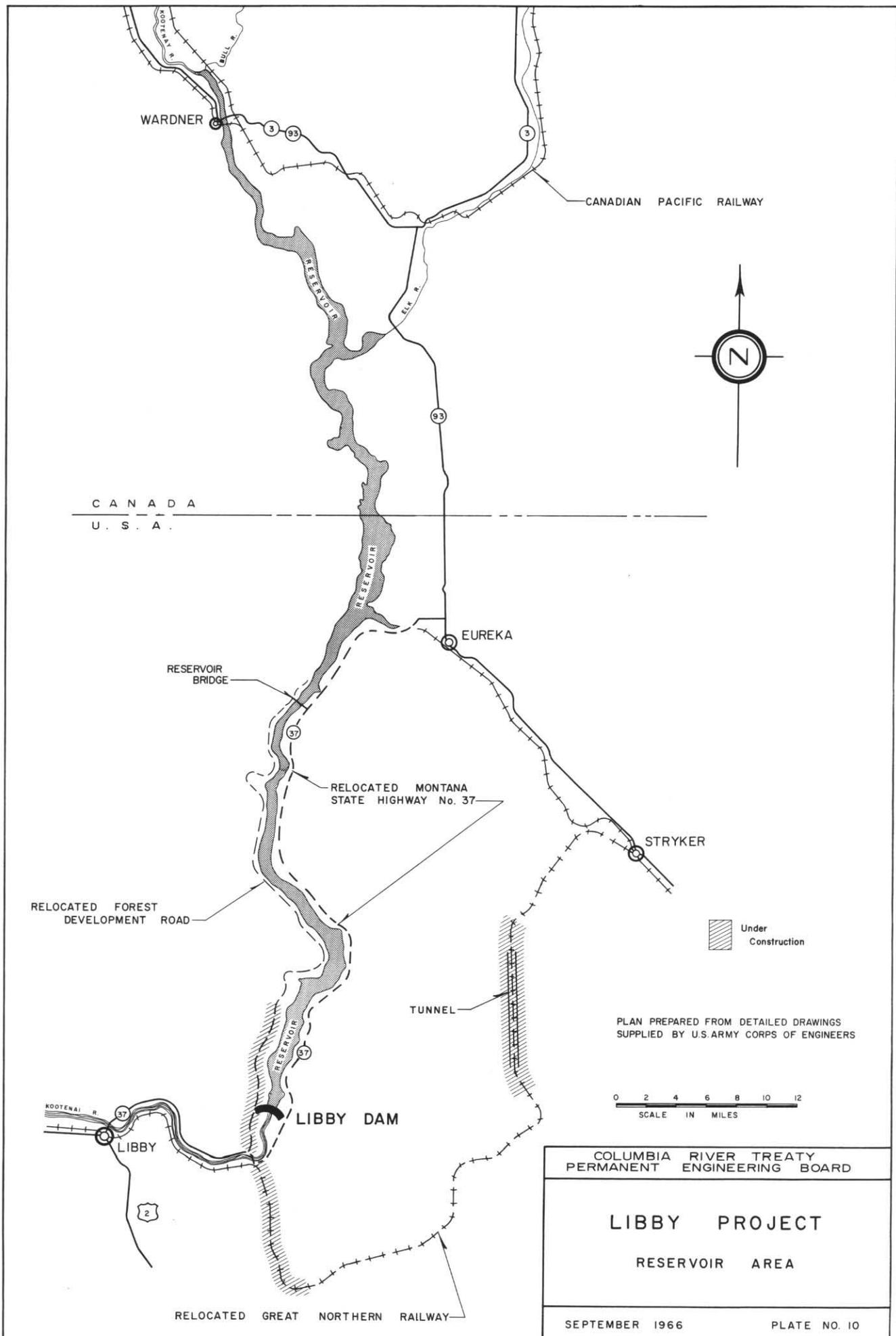
**MICA PROJECT**  
**HIGHWAY RELOCATION**

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



PLAN PREPARED FROM DETAILED DRAWINGS SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD	
LIBBY	PROJECT
GENERAL	ARRANGEMENT
SEPTEMBER 1966	PLATE NO. 9



PLAN PREPARED FROM DETAILED DRAWINGS  
 SUPPLIED BY U.S. ARMY CORPS OF ENGINEERS

0 2 4 6 8 10 12  
 SCALE IN MILES

COLUMBIA RIVER TREATY PERMANENT ENGINEERING BOARD	
LIBBY PROJECT	
RESERVOIR AREA	
SEPTEMBER 1966	PLATE NO. 10