PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT
WATER MANAGEMENT BRANCH

REPORT ON THE FLOODPLAIN MAPPING STUDY

PEACE RIVER, B.C. / ALBERTA BORDER TO SITE "C"

An Overview of the Study Undertaken
to Produce Preliminary Floodplain Mapping
for the Peace River

by

R.W. Nichols, P. Eng.
Senior Hydraulic Engineer
Special Projects Section

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REPORT ON THE FLOODPLAIN MAPPING STUDY

PEACE RIVER, B.C. / ALBERTA BORDER TO SITE "C"

PREFACE

The purpose of this report is to present a description of the methodologies used and an overview of the study undertaken to produce the attached preliminary floodplain mapping sheets, Drawing No. 85-37, Sheets 1 to 6.

Detailed information used in the study is available from sources listed in Appendix 1.

1. LOCATION

Preliminary floodplain mapping has been produced for a 36 mile reach of the Peace River between the British Columbia/Alberta Border and Site "C". The study area, shown on Appendix 2, is located in the Great Interior Plains which is one of the six main physiographic regions in the Province.

Figure V11-36 (Appendix 3 attached), from the British Columbia Energy Board Provincial Power Study February, 1972, indicates a plan and profile of the Peace Basin which includes the location of the preliminary floodplain mapping and the W.A.C. Bennett Dam, which is owned by the British Columbia Hydro and Power Authority (B.C.H.P.A.).

The height of the dam (600 feet), the storage capacity of the reservoir (57 million acre feet), and the capacity of the underground power facilities (2.27 million KW) combine to place the Peace River Hydroelectric project among the largest in the world. Construction of this project commenced in September, 1963 and the first commercial power delivery commenced in September of 1967. (Appendix 1.1).

The headwaters of the Peace River drainage area lie in the Rocky Mountain Trench which is drained from the north by the Finlay River, and from the south by the Parsnip River. The Peace River originates at their confluence, immediately west of the Rocky Mountains. The river then flows eastward through the mountains and continues across the interior plains to join the Mackenzie River system which drains to the Arctic Ocean.

The climate in the floodplain mapping study area is classified as humid-continental and is typical of the northern prairies with extreme sub-zero winter months and a short summer with frost-free periods of slightly more than two months. Minimum temperatures of minus 56° F and highs of 90° F have been recorded with average annual precipitation in the basin of about 24 inches. The drainage area above W.A.C. Bennett Dam is approximately 27,000 square miles (Appendix 1.1) and above Taylor, located in the floodplain mapping study area, is approximately 37,610 square miles (Appendix 1.2).

2. BACKGROUND

As a result of the lifting of the Peace River Site "E" flood reserve on May 31, 1985, the Ministry of Lands, Parks and Housing requested participation of the Ministry of Environment in a study to produce floodplain mapping of the Peace River between Site "C" and the B.C./Alberta border. It is the intent of the Ministry of Lands, Parks and Housing and the B.C.H.P.A. to avoid potential flood damage claims to the Province as a result of the lands being available to the public for Leases and/or Crown Grants.

In order to achieve their objective, it is intended that no developments subject to flood damage are to be allowed on lands within the designated floodplain limit. It should be noted that such a requirement exceeds that of the Ministry of Environment which, under open water conditions, would permit development in the floodplain fringe. Given the history of damage related to ice problems in the area (see February, 1979 Alaska Highway News, Appendix 4 attached) it was apparent that the approach adopted by the Ministry of Lands, Parks and Housing is appropriate.

A meeting was held on July 4, 1985, at 765 Broughton Street in Victoria, attended by representatives of the Ministry of Environment, the Ministry of Lands, Parks and Housing and the B.C.H.P.A., to discuss the production of preliminary floodplain mapping for the study area.

B.C.H.P.A. Report No. H 1844 "Memorandum on Peace River Flood Zone Elevation Limits" (Appendix 5) was discussed and it was agreed that the report represents the best information available with regard to calculated flood levels for the study area. It was noted that the report did not outline the designated floodplain area. The Ministry of Lands, Parks and Housing was anxious to have the floodplain limits shown on the existing mapping of the study area in order to ascertain their effect on administrative decisions related to Leases and/or Crown Grants.

The Ministry of Environment agreed to provide the preliminary floodplain mapping for the study area.

3. FLOOD MAGNITUDES

3.1 Maximum Probable Design Flood - W.A.C. Bennett Dam

The spillway at the W.A.C. Bennett Dam has been designed to pass a maximum probable design flood having a May-June volume of 46.7 million acre-feet. Inflow to the reservoir peaks at over 1.25 million cfs resulting in a maximum spillway outflow of 341,000 cfs with 15 feet of freeboard to the dam crest (Appendix 1.1).

3.2 Unregulated Flood at Taylor

The highest recorded daily flow at Taylor (W.S.C. Gauge 7FD002) for the period of record (1945 to date) occurred on May 30, 1948. The flow of 406,100 cfs has an estimated (unregulated) return period of 1:36 years. The 1:200 year (unregulated) return period daily flow at Taylor is estimated by Environment Canada to be approximately 459,000 cfs (Appendix 1.2).

3.3 Designated Flood

In accordance with the policy of the Ministry of Environment, where the flow of a large watercourse is controlled by a major dam, the designated flood should be set on a site specific basis. For the purposes of the study, the designated floodplain limits were based on an analysis of flood levels resulting from the three cases considered in the B.C.H.P.A. Report No. H 1844 as follows:

Case 1 - discharge equal to the 1:200 year regulated flood peak (open water conditions, 229,500 cfs at Taylor).

Case 2 - discharge equal to the 1:200 year inflow downstream of Hudson Hope plus maximum turbine discharge (open water conditions, 282,500 cfs at Taylor).

Case 3 - discharge equal to the average winter inflow downstream of Hudson Hope plus maximum turbine discharge (ice conditions, 75,900 cfs at Taylor).

A frequency analysis by the Surface Water Section, Ministry of Environment, using regulated flows for a 16 year period from 1968 on, resulted in an estimated 1:200 year return period daily flow of approximately 278,000 cfs at

Taylor. As discussed in Section 4.2, the winter flow condition generally results in the highest flood levels in the study area.

4. B.C.H.P.A. REPORT NO. H 1844

4.1 General

The report (Appendix 5) was based on a total of 43 sections, 18 of which were manufactured from topographic maps and adjusted until known stage-discharge conditions were duplicated.

The slope of the water surface profile between Site "E" and Site "C" averages 2.5 feet per mile over the 36 mile reach. In keeping with maximum reach lengths suggested for the HEC-2 program, normally 72 cross sections would be obtained in this reach for flood profile calculation purposes.

There are six stage discharge gauges established in the model area which were utilized in the study. Maximum open water stages and discharges at Taylor and above Alces River were compared in the report with the Case 1 and Case 2 stages and discharges. It appeared that the computed stages for discharges at Alces River are low. More data would be required to confirm the apparent discrepancy in the simulator model.

B.C. Hydro Ice Simulator Model (B.C.H.ICE) was used to compute river stages during ice conditions for Case 3 flows. B.C. Hydro has monitored ice conditions on the Peace River downstream of W.A.C. Bennett Dam since 1973. A description of the ice jamming mechanism observed during the ice cover advance, the levels recorded at the jams and the results of analysis through the use of models is contained in a paper entitled "Analysis of Freeze-up Ice Jams in the Peace River near Taylor, British Columbia" (Appendix 1.5). Comparison was made with known stages and discharges at Taylor and Alces River and, again, it appeared that the computed stages at Alces River are low.

4.2 Flood Levels

4.2.1 Upstream of Beaton River Confluence Area

Upstream of the Beaton River confluence area (i.e. upstream of cross section 130), the highest Peace River flood levels occur under Case 3 flows with maximum turbine discharge and ice cover conditions. Table 4 of the B.C.H.P.A. report indicates that the recommended flood levels averaged 9.5 feet above Case 2 flood levels and 11.5 feet above Case 1 flood levels in this reach.

Flood levels on the Peace River at Taylor at W.S.C. Gauge 7FD002 (X-Section 124), located downstream of the Pine River confluence, are summarized as in Table 1.

4.2.2 Downstream of Beaton River Confluence Area

Downstream of cross section 130, the recommended flood levels shown on Table 4 of the B.C.H.P.A. Report are 3.3 feet above the maximum calculated river stage because of a lack of surveyed river cross sections in this reach and the apparent low bias of the calculated stages near the Alces River confluence. In this reach, Case 3 flood levels average 2.6 feet above Case 2 levels. At cross sections 140 and 144 as shown on Table 4, the Case 2 level was higher than Case 3.

The reader is referred to the B.C.H.P.A. report for more detailed information regarding the study.

5. PRELIMINARY FLOODPLAIN MAPPING

The recommended flood levels listed in Table 4 of the B.C.H.P.A. study were adopted by the Special Projects Section to locate the designated floodplain limits on the existing topographic mapping of the study area. The cross section locations and flood levels as shown on the mapping sheets were provided by B.C.H.P.A. The attached floodplain mapping sheets were produced and indicate the following information:

- the study area covers approximately 36 miles of the Peace River between the B.C./Alberta border and Site "C". The slope of the flood profile averages 0.05% in this reach.

- the planimetric, 20 foot contour, 1"=1000', topographic mapping indicates the location of the river cross sections, the designated floodplain limits and the flood levels determined in the study.

- the designated floodplain area is generally not significantly greater than the area inundated under bank full flow conditions since the Peace River in the study area flows through a "U" shaped [steep sided] valley.

6. CONCLUSIONS AND RECOMMENDATIONS

1. This report serves to present an overview of the studies undertaken to produce the preliminary floodplain mapping of the Peace River for a 36 mile reach between the B.C./Alberta border and Site "C".

2. The floodplain mapping is deemed to be preliminary as it is based on 20 foot contour mapping and the limitations noted in the study undertaken by B.C.H.P.A. The mapping is based on the best information available and the results can be used for administrative purposes regarding land use proposals in the floodplain.

3. The floodplain limits shown on the mapping apply to the main stem of the Peace River only. Lands within the floodplain limits form part of the lands affected by the Peace River Site "E" flooding reserve which was lifted in May of 1985. These lands may be made available to the public for Lease and/or Crown Grants. It is recommended that no development subject to flood damage be allowed within the designated floodplain area.

4. Tributaries to the Peace River such as the Beatton River, Pine River, etc., were also affected by the Site "E" flooding reserve. Floodplain limits and

flood levels have not been determined for such tributaries. Covenant conditions related to flooding in such areas in which Leases and/or Crown Grants are to be issued should be referred to the Water Management Branch - Northern Region for review.

R.W. Nichols, P. Eng.
Senior Hydraulic Engineer
Special Projects Section

RWN:skl:res:hs

TABLE 1

FLOOD LEVELS - PEACE RIVER AT TAYLOR

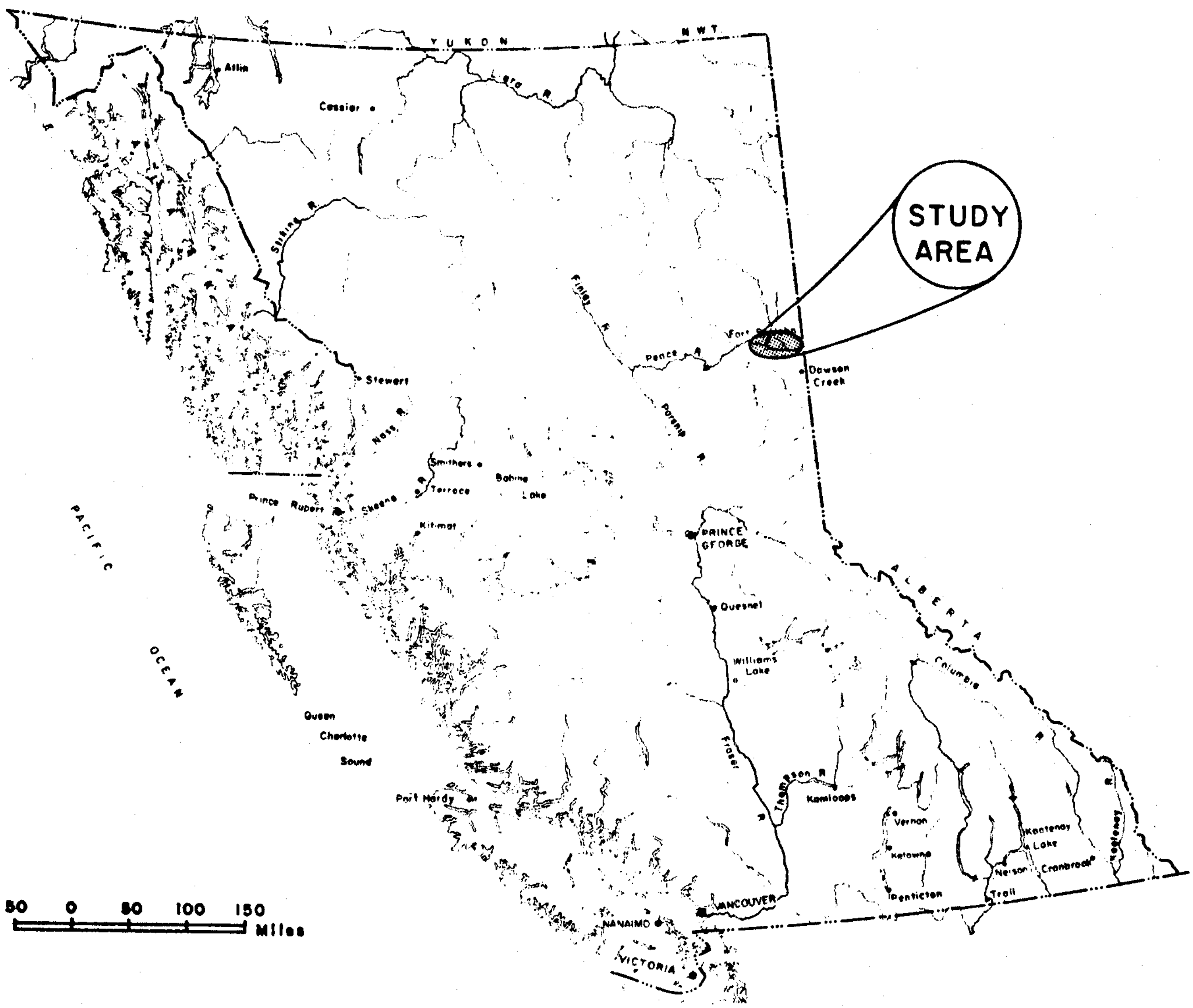
(W.S.C. GAUGE 7FD002)

LEVEL	COMMENTS
1349.1 feet (411.2 m)	Case 3, winter conditions. Q = 75,900 cfs. (Source - B.C.H.P.A. Report No. H 1844)
1339.2 feet (408.2 m)	Highest recorded (unregulated) open water condition flow, May 30, 1948. Q = 406,600 cfs. (Source - Appendix 1.5)
1337.3 feet (407.6 m)	Case 2, regulated open water condition. Q = 282,500 cfs (Source - B.C.H.P.A. Report No. H 1844)
1335.0 feet (406.9 m)	Case 1, regulated open water conditions. Q = 229,500 cfs (Source - B.C.H.P.A. Report No. H 1844)
1334.3 feet (406.7 m)	Freeze-up February - March 1979. Q = 62,860 cfs. (Source - Appendix 1.5 and B.C.H.P.A. Report No. H 1844)

APPENDIX 1

Detailed Information Sources Used in the Floodplain Mapping Study - Peace River

Source	Contents
1. The Engineering Journal, October 1969, Vol. 52/10, Engineering Institute of Canada	Featuring the Peace River Hydro-Electric Project.
2. Environment Canada, "Magnitude of Floods British Columbia Yukon Territory", September, 1982	Flood estimates from gauging stations in British Columbia and and the Yukon Territory.
3. Memorandum on Peace River Flood Zone Elevation Limits, Report No. H1844, June, 1985, B.C.H.P.A.	Description of methodologies used and results of studies to determine flood elevations.
4. Ministry of Environment, Map Production Divison, Surveys and Resource Mapping Branch, Project No. M306, 1972	20 foot contour, 1 inch = 1000 feet planimetric mapping of study area
5. "Analysis of Freeze-up Ice Jams on the Peace River Near Taylor, British Columbia", Canadian Journal of Civil Engineering, Vol. 9(2) 1982, pp. 176-188.	Monitoring of ice conditions on the Peace River by B.C. Hydro and examination of various ice simulation models to assess applicability to the Peace River.



STUDY AREA LOCATION

Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON
PRELIMINARY FLOODPLAIN MAPPING STUDY
PEACE RIVER
(B.C./Alberta Border to Site "C")

SCALE VERT ....
HOR AS SHOWN

DATE DECEMBER 1985

R. W. NICHOLS ENGINEER

FILE No 22-0000-S.1 APPENDIX No. 2

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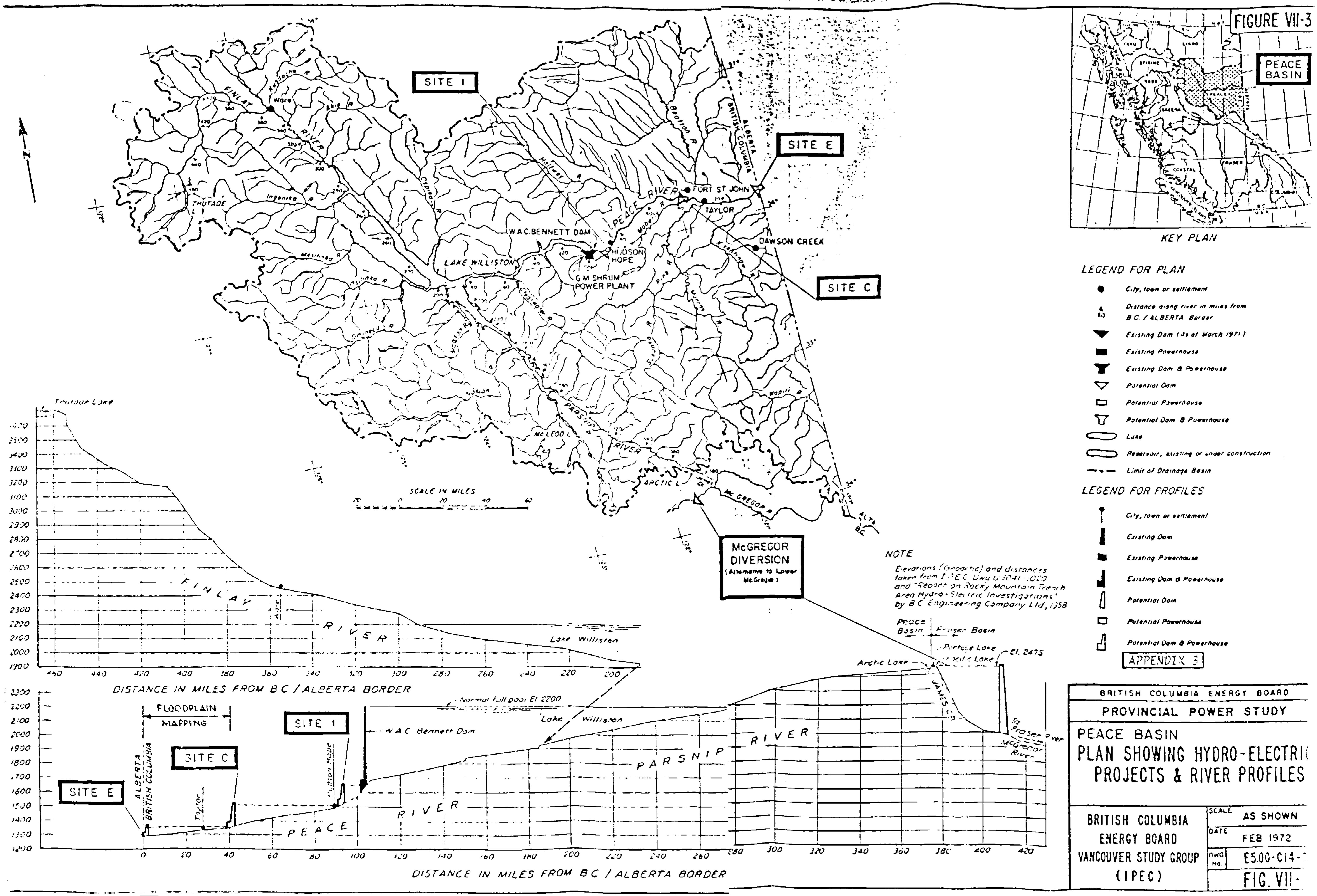


BRITISH COLUMBIA ENERGY BOARD

PROVINCIAL POWER STUDY

PEACE BASIN

PLAN SHOWING HYDRO-ELECTRIC PROJECTS & RIVER PROFILES

BRITISH COLUMBIA ENERGY BOARD
VANCOUVER STUDY GROUP
(IPEC)

SCALE: AS SHOWN
DATE: FEB 1972
DWG No: E5.00-C14-
FIG. VII-

PIPELINE TO THE PEOPLE OF THE PEACE

DAILY ALASKA HIGHWAY NEWS

Second Class Mail
Registration No. 0162

Vol. XL No. 184 | FORT ST JOHN, BC, WEDNESDAY, FEBRUARY 28, 1979 | 24 Pages, $36 Per Year, 20 Cents Per Copy

Rising river scares Old Fort residents

A sudden rise in the level of the Peace River on Monday night has alarmed residents of the Old Fort, and caused property damage of approaching $20,000. The rise was occasioned by an ice front reaching back to the area restricting the flow of the river, which was further exacerbated by the release of water from Lake Williston as BC Hydro responded to a demand for power on Monday.

The level appears to have stabilised now, at approximately 15 feet above the normal level of the river. BC Hydro are monitoring the problem and are doing what they can to alleviate the situatiuon.

However, Lorne Nelson, superintendent at the GM Shrum Generating Station, commented, 'There are many factors such as the ice formation and the cool weather that are beyond our control. We don't have much room to manouevre.

City lawyer Gary Callison stated yesterday that ice packs had demolished a greenhouse and a boatshed on his riverside property, which were at a lower level than his house. He estimates his loss at between seven and ten thousand dollars.

A few hundred yards downstream from him, the Rocky Peck family lost three vehicles to the ice and fear that a boat ramp which they constructed at a cost of $4,000 will also be damaged.

The water came a good deal closer to their house than it did to the Callison's and Mrs Peck took the precaution of boarding her seven children out last night as well as parking the school bus she drives facing up hill for a fast get away.

COLD WINTER

Though seasonal flooding was a frequent occurence before the building of the Bennett Dam, it has been unusual for the river to freeze at all since the dam's completion.

This year's unusually cold winter has been blamed for the freezing of the river which has steadily advanced back upstream from the Alberta border, reaching Taylor a few weeks ago. At that time, BC hydro were able to reduce flows a little to try and give the ice a chance to form and get upstream of Taylor. (The potential for flooding is always worst where the water meets the ice.)

The company has tried to maintain a steady flow though and while still having the generating station operating at only 80 per cent capacity, was obliged to boost production on Monday after the weekend.

'Ice is unpredictable,' commented Nelson. 'We did not expect a major rise in the river level, maybe just a foot.' As it turned out, the level rose five feet on Monday night.

He added that though no major boosts to production were planned in the next few days, any change in circumstances would be transmitted directly to river-bank residents.

Nelson expects the level to start declining now, as the ice front is now a mile above the Old Fort. There is unlikely to be a problem downstream, as the river will merely gouge out a deeper channel beneath the ice, rather than say, flood Taylor.

Claims for property damage may be submitted to BC Hydro's claims department, a course of action which Callison states that he has already initiated.

APPENDIX 5

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY

HYDROELECTRIC GENERATION PROJECTS DIVISION

DEVELOPMENT DEPARTMENT

MEMORANDUM ON PEACE RIVER FLOOD ZONE ELEVATION LIMITS

JUNE 1985

Prepared By ______________________
Hydrology Section

Approved By ______________________
Manager, Development Department

REPORT NO. H 1844

D1821

MEMORANDUM ON PEACE RIVER FLOOD ZONE ELEVATION LIMITS

1. INTRODUCTION

The Provincial Government has rescinded the Peace Site E Flood Reserve to permit land use along the Peace River downstream of Site C to the B.C.-Alberta border. To avoid development of lands along the river that would be periodically flooded as a result of upstream hydroelectric plant operation, flood plain elevation limits are to be defined and development within these limits restricted. The purpose of this memorandum is to describe the methodologies used and present the results of studies to determine appropriate flood zone elevation limits along the Peace River.

2. FLOOD FREQUENCY ANALYSIS

A 200-year return period flood condition was adopted as the appropriate flow for the determination of the flood zone elevation limits. Three cases were considered:

Case 1

Discharge equal to the 200 year regulated flood peak. (open water conditions).

Case 2

Discharge equal to the 200 year inflow downstream of Hudson Hope plus maximum turbine discharge. (open water conditions).

Case 3

Discharge equal to average winter inflow downstream of Hudson Hope plus maximum turbine discharge. (ice conditions).

The highest stage as defined by these three cases should be adopted as the flood plain limit, so that areas flooded by either a 200-year flood or by normal generation at the upstream G.M. Shrum and Peace Canyon hydroelectric plants would not be developed. Since the turbines at the proposed Site C project would have a similar hydraulic capacity, these flood limits would also apply if Site C is constructed.

Flood frequency analyses of annual (mean daily) flood peaks based on a lognormal distribution were carried out for Case 1 and Case 2 conditions and the results are summarized in Table 1 and Table 2 respectively. For Case 1 regulated flow conditions were assumed to commence in 1972 when the reservoir at the G.M. Shrum plant was initially filled. For Case 2, inflows downstream of Hudson Hope were calculated assuming a one day lag time between Hudson Hope and Taylor, and a two day lag time between Hudson Hope and Town of Peace River. As a check, flows were also calculated with the above lag times reduced by one day, but since peak flows were generally slightly lower the longer lag times were adopted.

The adopted flows for various reaches of the Peace River for Case 1 and Case 2 conditions are summarized in Table 3.

3. WINTER FLOW CONDITIONS

During the winter the temperature of water released from the upstream reservoirs is usually about 1°C to 2°C, and the river remains open during the winter for many miles downstream. It is only during exceptionally cold winters (such as 1978/79, 1982/83 and 1984/85) that the ice front advances upstream as far as Taylor. Also the ice front as a result of warmer weather in the spring usually retreats downstream of the B.C.-Alberta border before tributary inflow downstream of Hudson Hope appreciably increases the discharge of the Peace River.

Since the maximum winter river stage at any given location along the river is a function of the maximum discharge that occurs while an ice cover exists at that location, for the Peace River between Site C and the B.C.-Alberta border a maximum winter discharge during ice conditions equal to full turbine discharge (2100 m^3/s) plus an average winter tributary flow from the Peace River and the Smoky River of 50 m^3/s each was adopted. The corresponding winter stages could occur more frequently than a 200-year event, but river stages for a 10-year or a 200-year occurrence would be approximately the same. A summary of Case 3 condition flows is included in Table 3.

4. EQUIVALENT RIVER STAGES

a) Open Water Conditions

The HEC-2 computer model developed by the U.S. Corps of Engineers to compute water surface profiles, has been calibrated for the Peace River from downstream of the town of Peace River upstream as far as the Peace Canyon project. River cross-sections used in the model between Site C and B.C.-Alberta border are shown on the attached Figure. It should be noted that surveyed cross-sections are not available for the reach of the river from upstream of the Beatton R. confluence to the Alces R. confluence, and cross-sections along this reach were estimated from topographic maps and adjusted until known stage-discharge conditions were duplicated.

The resulting river stages at selected river cross-sections for Case 1 and Case 2 flow conditions are presented in Table 4.

The Case 1 and Case 2 stages and discharges at Taylor and above Alces River are compared with the maximum recorded open water stages and discharges below:

Station	Recorded				Case 1		Case 2	
	Period	Date	Q	W.S.El.	Q	W.S.El	Q	W.S.El.
			(m³/s)	(m)	(m³/s)	(m)	(m³/s)	(m)
Taylor	1972-84	13 Jul.72	5690	405.6	6500	406.9	8000	407.6
Alces R.	1975-84	5 Aug. 76	5310(est)	388.0	8300	388.7	8800	389.0

From the above comparison it appears that the computed stages at Alces River are slightly low. River cross-sections surveyed to GSC datum and recorded river stages during high discharges would be required to confirm this apparent discrepancy, and permit adjustments to the simulation model.

b) Ice Conditions

The B.C. Hydro Ice Simulation Model (BCHICE) was used to simulate river stages during ice conditions for the Case 3 flows. This model has been calibrated for the Peace River from downstream of the town of Peace River, upstream as far as the Peace Canyon hydroelectric plant. The same river cross-sections as used in the HEC-2 model and shown of the attached Figure are used in the ice model. The model uses river channel hydraulic characteristics, discharge data, and air temperature data, together with ice formation and ice stability relationships to simulate ice volume, ice cover thickness, river stage and ice cover progression or recession.

To determine Peace River winter stages equivalent to the Case 3 flows, ice conditions were simulated under -30°C air temperatures and constant flow (Case 3) conditions. Under these conditions approximately two months were required for the ice front to advance upstream from the town of Peace River to Site C. The resulting river stages at selected river cross-sections for the Case 3 flow conditions are included in Table 4. The Case 3 stages and discharges at Taylor and above Alces River are compared with maximum recorded winter stages and discharges below:

Station	Recorded				Case 3	
	Period	Date	Q (m^3/s)	W.S.El. (m)	Q (m^3/S)	W.S.El. (m)
Taylor	1972-84	16 Feb. 79	1780	406.8	2150	411.2
Alces R.	1975-84	16 Feb. 82	1930	390.0*	2150	390.9

* Similar stage occurred 10 Feb. 1979.

Again it appears that the computed stage at Alces River is slightly low.

5. CONCLUSIONS AND RECOMMENDATIONS

From Table 4 it is apparent that, except for the river reach between the Beatton and Alces River where Case 2 governs, the highest Peace River stage occurs under Case 3 flows with maximum turbine discharge and ice cover conditions. Recommended flood zone elevation limits based on the highest stage indicated for the three conditions are also shown in Table 4. Because of the lack of surveyed river cross-sections from upstream of the Beatton River confluence, downstream to the Alces River and the apparent low bias of the calculated stages at Alces R., the maximum calculated river stages downstream of the cross-section 130 have been increased by 1.0 m to obtain the recommended flood zone elevation limits.

TABLE 1

LOGNORMAL FLOOD FREQUENCY ANALYSIS
PEACE RIVER REGULATED 200 YEAR MEAN DAILY FLOOD PEAKS

WSC Stations	Period of Record	Drainage Area (km^2)	Q_{200} (m^3/s)	Standard Error (%)	R^2 %
Peace R. @ Hudson Hope	1972-84	70,200	3890	14.9	72.6
Peace R. @ Taylor - Pine R.	1972-84	85,300	6080	22.5	79.8
Peace R. @ Taylor	1972-84	97,400	6480	16.3	85.4
Peace R. @ Dunvegan	1975-84	130,000	8240	20.5	83.6
Peace R. @ Peace River - Smoky R.	1972-84	135,800	8360	17.8	91.8
Peace R. @ Peace River	1972-84	186,000	17000	22.8	82.6

D1817

TABLE 2

LOGNORMAL FLOOD FREQUENCY ANALYSIS

PEACE RIVER 200 YEAR MEAN DAILY PEAK INFLOWS DOWNSTREAM OF HUDSON HOPE

WSC Stations	Period of Record	Drainage Area (km^2)	Q_{200} (m^3/s)	Standard Error (%)	R^2 %
Taylor (i) - Hudson Hope (i-1) - Pine (i)*	1961-83	15,100	3870	19.9	96.6
Taylor (i) - Hudson Hope (i-1)	1952-83	27,200	5860	12.5	94.9
Taylor (i) - Hudson Hope (i-1) + Beatton (i)	1961-83	42,800	6680	15.1	96.7
Peace River (i) - Hudson Hope (i-2) - Smoky (i)	1958-83	65,600	8930	16.2	96.3
Peace River (i) - Hudson Hope (i-2)	1958-83	115,800	16300	17.8	94.1

* Note lag times of 1 day and 2 days between Hudson Hope and Taylor, and between Hudson Hope and Peace River as indicated, were adopted for the calculation of inflows downstream of Hudson Hope.

TABLE 3

PEACE RIVER REGULATED (MEAN DAILY) FLOOD DISCHARGES

River Location	Reach No.	Case 1 Regulated 200-Year Flood Peak (m^3/s)	Case 2 200-Year Local Inflow + Max. Turbine Release (m^3/s)	Case 3 Average Water Flow + Max. Turbine Release (m^3/s)
Site C	1	6100	3900 + 2100* = 6000	0 + 2100* = 2100
Pine R. (Taylor)	2	6500	5900 + 2100 = 8000	50 + 2100 = 2150
Beatton R.	3	8300	6700 + 2100 = 8800	50 + 2100 = 2150
B.C. - Alberta Border	4	8400	8900 + 2100 = 11000	50 + 2100 = 2150
Smokey R.	5	17000	16300 + 2100 = 18400	100 + 2100 = 2200

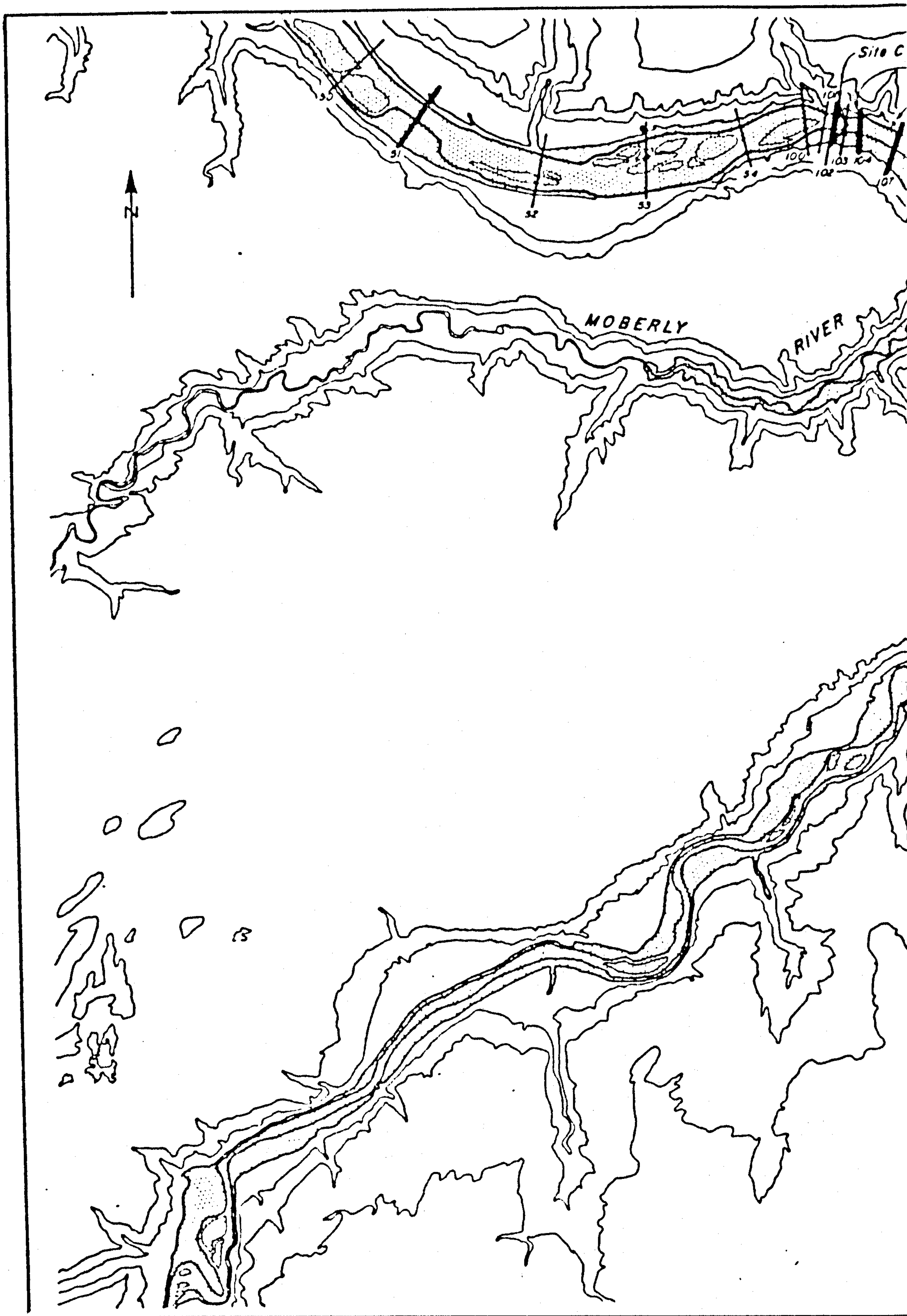
* Max. turbine release at GMS/PCN hydroelectric plants.

D1817

TABLE 4

PEACE RIVER 200-YEAR RETURN FREQUENCY WATER SURFACE ELEVATIONS (M)

Location	Section No.	Case 1	Case 2	Case 3	Recommended Flood Limit
Site C	110	414.6	414.6	417.7	417.7
	113	413.0	413.1	416.0	416.0
	115	411.7	412.0	415.0	415.0
	119	410.1	410.9	414.0	414.0
	120	409.0	409.8	413.9	413.9
	122	407.9	408.7	412.4	412.4
Taylor	124	406.9	407.6	411.2	411.2
	126	406.4	407.2	409.2	409.2
	128	404.4	405.1	406.9	406.9
	130	402.2	402.8	404.8	404.8
	132	400.4	400.8	401.9	402.9
Beatton R. Confluence	134	399.8	400.0	401.1	402.1
	137	398.4	398.6	399.4	400.4
	140	396.9	397.1	395.7	398.1
	144	393.7	393.9	393.3	394.9
	148	390.1	390.4	391.5	392.5
Alces R.	150	388.7	389.0	390.9	391.9
	153	385.4	386.8	389.3	390.3
B.C.-Alberta Border					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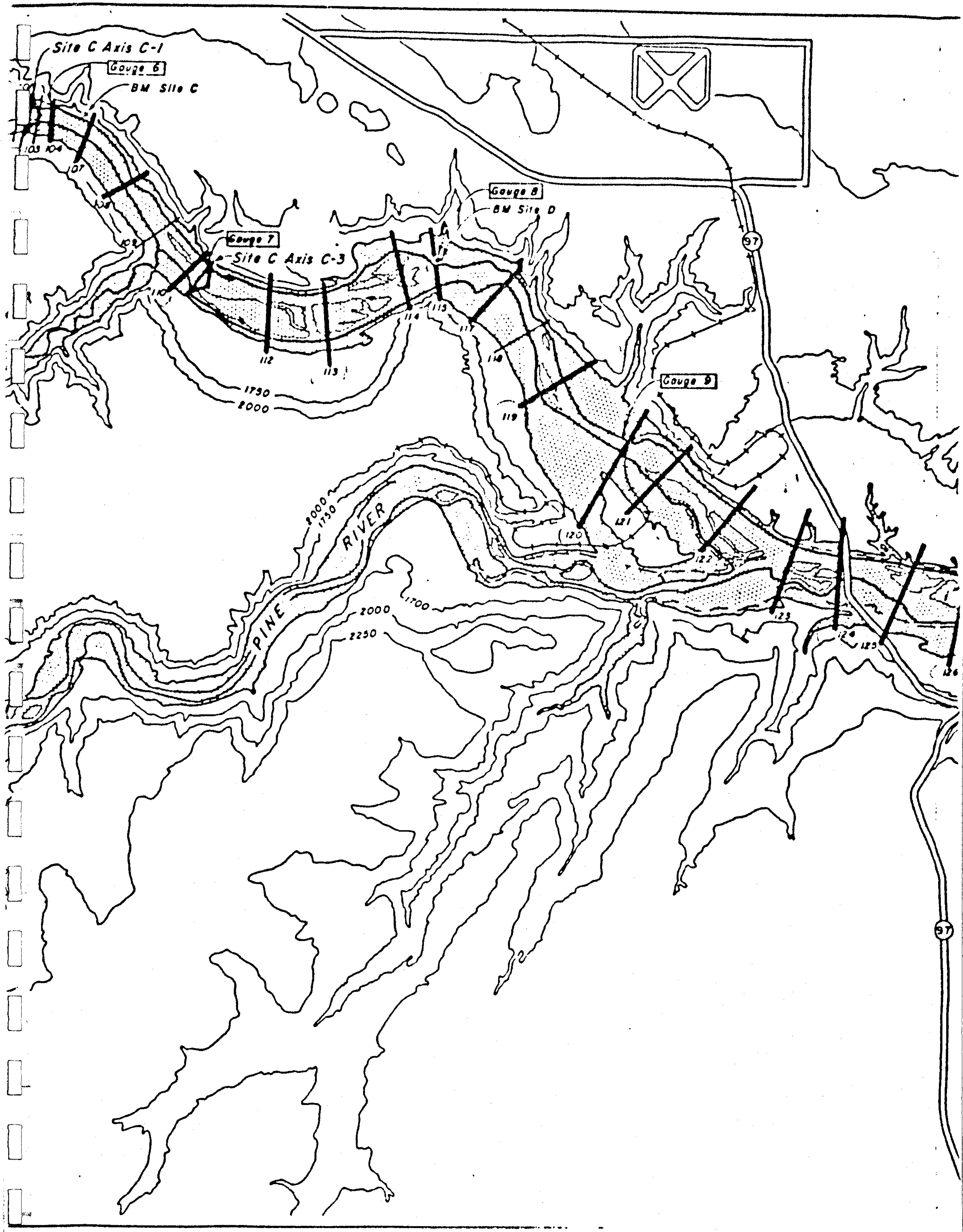
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Gauge 8
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Gauge 9
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1750
PINE RIVER
1700
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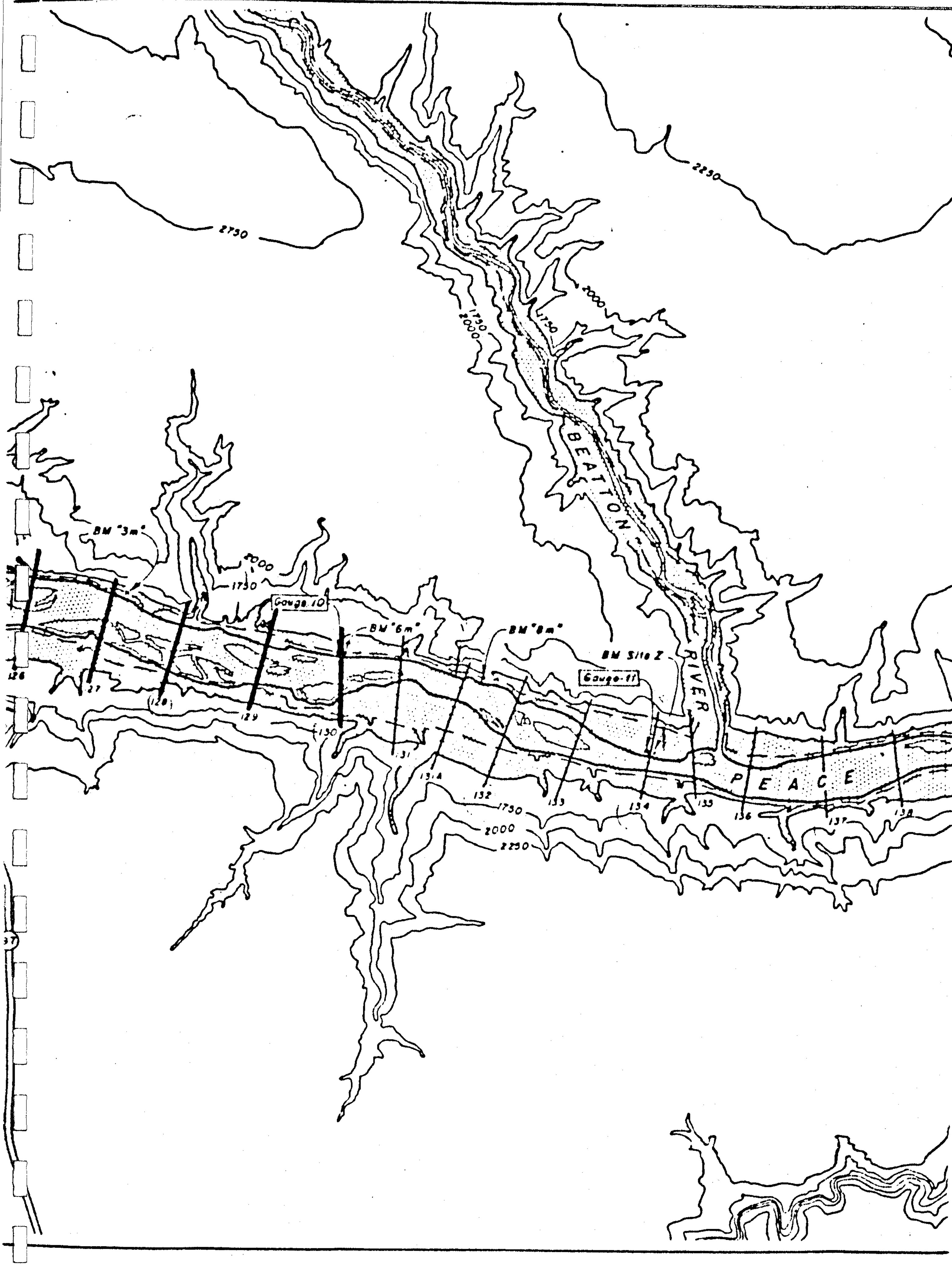
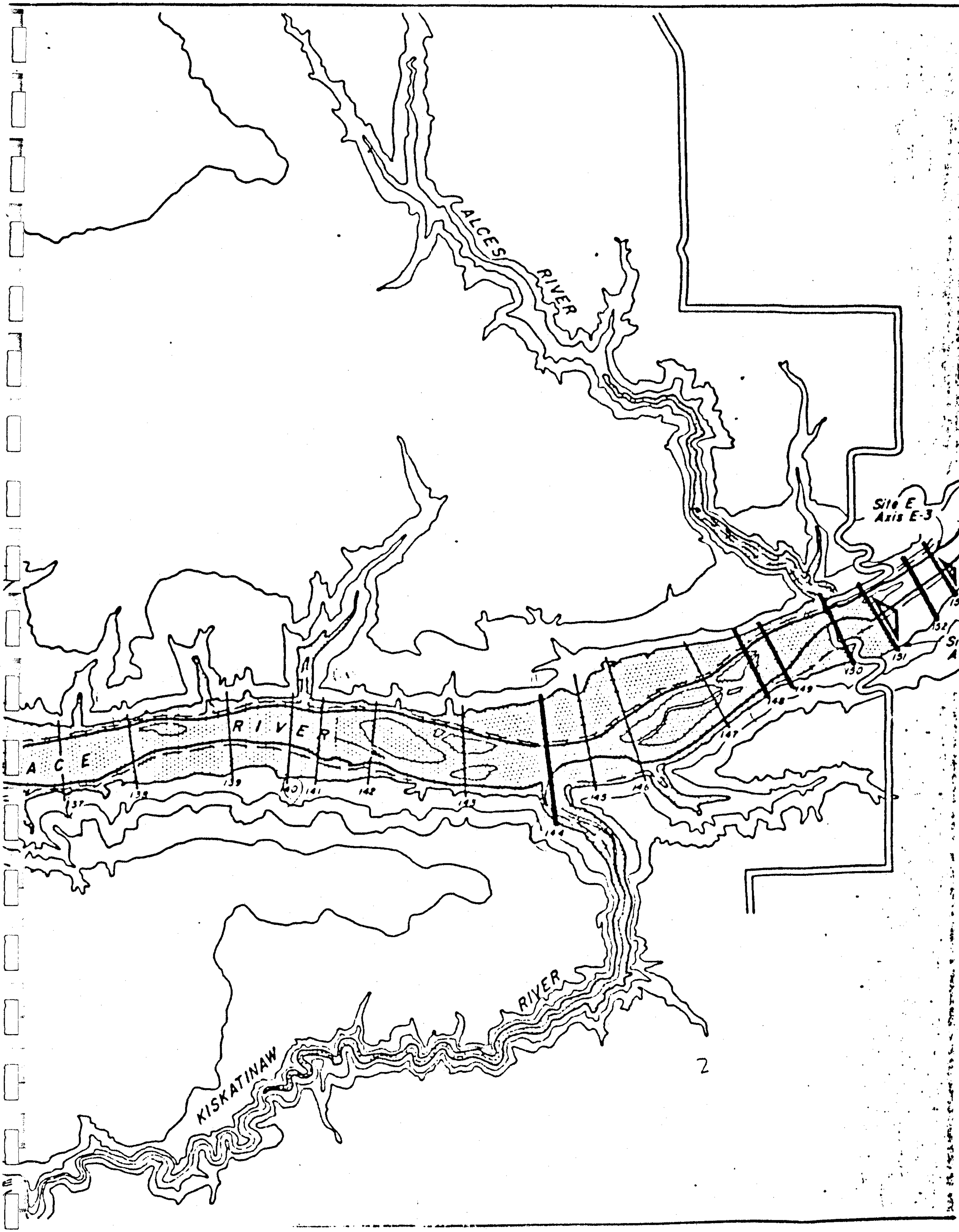
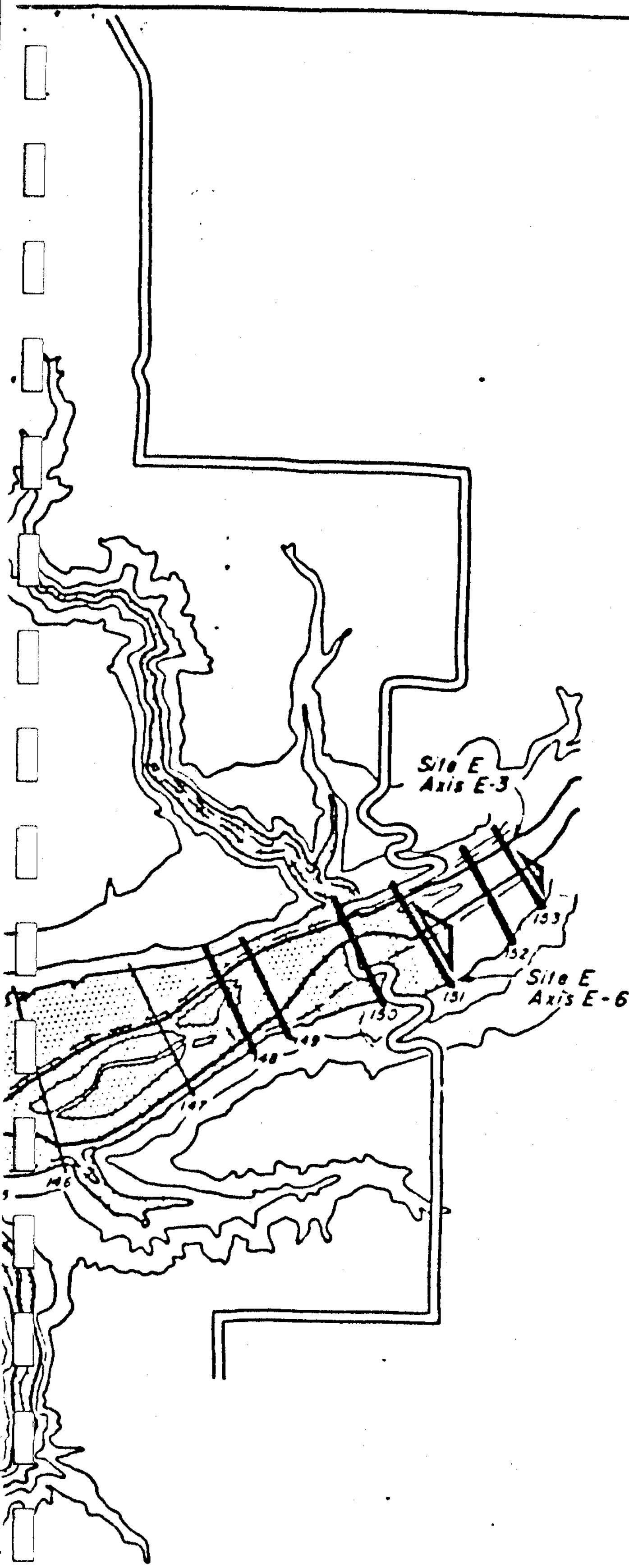
2250
97


2750
2250
2000
1750
1750
2000
BEATTON
RIVER
PEACE
BM "3m"
BM "6m"
BM "8m"
BM 5118 Z
Gauge 10
Gauge 11
126
127
128
129
130
131
131A
132
133
134
135
136
137
138
1750
2000
2250
37


ALCES RIVER
Site E
Axis E-3
A C E
R I V E R
KISKATINAW RIVER
137
139
140
141
142
143
144
145
146
147
148
149
150
151
152



LEGEND

- Existing river bank
- Reservoir maximum level Site C or Site E high dam El. 1510
- Cross-section location (From topography) (12)
- Cross-section location (Surveyed) (25)

Scale 1 0 1 2 3 Miles

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY	
PEACE RIVER ICE SIMULATION PEACE RIVER PLAN & LOCATION OF RIVER SECTIONS SHEET 2	
DATE NOV 1984	FIG. 3-B R
DWN CY	DWG No. 1016 - C14 - D1806