PROVINCE OF BRITISH COLUMBIA
MINISTRY OF ENVIRONMENT
WATER MANAGEMENT BRANCH

REPORT ON THE FLOODPLAIN MAPPING STUDY

BULKLEY RIVER - QUICK AREA

An Overview of the Study Undertaken to Produce Floodplain Mapping for the Bulkley River near Quick (Regional District of Bulkley Nechako)

by

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PREFACE

The purpose of this report is to present a description of the methodology used and results of the study undertaken to produce the attached preliminary floodplain mapping sheets, Drawing 86-23, Sheets 1 to 4. The study area covers a total of 11.8 km. of the Bulkley River in the Quick area. Detailed information sources used in the study are listed in Appendix 1.

1. LOCATION

The study area is located approximately 25 km. southeast of Smithers, as shown on Figure 1, in the Intermontane System, one of the six main physiographic regions in the Province. Mean annual precipitation in the study area averages between 40 to 50 cm. which is low in comparison to the main tributary to the Bulkley River, the Morice River, where values exceed 350 cm. (Appendix 1.1).

The Bulkley River flows 55 km. in a westerly direction from Bulkley Lake in the Nechako Plateau through the District of Houston to the Morice River confluence. Downstream of this confluence, the river flows to the northwest a distance of 125 km. passing through Quick, Telkwa and Smithers to the confluence of the Skeena River at Hazelton.

A hydrometric gauge (08EE004) has been maintained at Quick from 1931 to date. The drainage area at the guage is 7,360 square km.

2. BACKGROUND

The Water Management Branch issued floodplain mapping of the Bulkley River from Smithers to upstream of Telkwa (Dwg. No. 84-68 sheets 1 to 8) in December of 1984. This study extends the existing Bulkley River floodplain mapping a further 11.8 km. to include the Quick area.

The Water Management Branch of the Ministry of Environment was involved in an assessment of ice jam flooding which occured on the Bulkley River at Quick in December of 1984. A review of the information available (Appendix 1.2 to 1.4) indicates that ice jamming problems similar to the 1984 event may have occurred on only two other occasions since 1937 at Quick. Appendix 1.4 summarizes river freeze-up processes and factors producing high stages and flooding under freeze-up conditions.

Local residents of Quick noticed a rapid rise in the river level at around 10:00 p.m. on December 24, 1984. Residents of several homesites were forced to evacuate the area as a precautionary measure. The extent of ice coverage on the Bulkley River was approximately 16 km. on December 28, 1984, extending 8 km. upstream of Quick and covered the entire floodplain mapping study area.

The flooding experienced in December, 1984, was localized in the vicinity of Quick and ice blocks on the ground extended 100 m from the left bank. Actual flood damages in 1984 were reported to be minimal. Ice levels associated with this event are discussed in Section 6.5.

Available information (Appendix 1.3) indicates that ice jam flooding problems along the Bulkley River is not unique to the Quick area. On April 8, 1966 a massive volume of break-up ice took out the highway bridge located in Smithers near Riverside Park. The banks upstream of the bridge overflowed and caused flooding of Vetterli farm and Lubbers' Trailer Court (Appendix 1.5). The highway bridge has since been relocated to an upstream site.

Information provided by the Ministry of Highways indicates that past ice problems at Quick resulted in the existing bridge being installed at a higher elevation than the previous bridge. During the fall of 1967, the pre-construction surveys were disrupted by an ice jam formation at Quick.

It should be noted that the flood profile calculations outlined in Section 6 are based on open water conditions and do not reflect problems related to ice jam flooding.

3. DESIGNATED FLOOD

In accordance with the policy of the Ministry of Environment, the flood levels and floodplain limits shown on the floodplain mapping sheets are based on a designated flood (1:200 year frequency), plus an allowance for freeboard, assuming open water flood conditions. In addition to the above, a 1:20 year frequency flood level (freeboard included) is shown on the mapping sheets for administrative purposes related to septic tank requirements.

4. SURVEY DATA

River survey data used in the study was obtained in the field on September of 1985 by staff of the Surveys Section, Water Management Branch. A total of 21 river cross-sections were obtained and the hydrometric gauge located at the bridge at Quick (Figure 2) was related to G.S.C. datum. Elevations related to ice levels were obtained upstream of the bridge at Quick. Appendix 1.6 outlines the data obtained during the river survey (Project 85 RPP12).

Planimetric topographic base mapping for the study area was produced by the Mapping Section, Surveys and Resource Mapping Branch, Ministry of Environment as indicated in Appendix 1.7. The mapping has a 2 metre contour interval with spot heights and is based on air photography taken in June of 1982.

5. FLOOD MAGNITUDES

The Surface Water Section, Water Management Branch estimated the required peak flows for the study area based on the hydrometric gauge at Quick. The drainage area at Quick is 7,360 sq. km. and the gauge has been in operation since 1931. The maximum recorded daily flow of record which occurred on June 13, 1972, was 957 cms. The maximum metered flow which occurred on the same day as the maximum recorded flow, was 946 cms. During 49 of the the 54 year record period (1931 to 1984), the maximum annual daily flow occurred in the months of May or June. In the other 5 years of record, the annual daily maximums occurred in the October to November period 3 times and twice in April. The maximum fall flow of record was 838 cms. on October 26, 1935.

The estimated 1:20 year and 1:200 year daily and instantaneous flows used in the floodplain mapping study are as follows:

1:20 year (daily) = 886 cms. (instantaneous) = 930cms.

1:200 year (daily) = 1050 cms. (instantaneous) = 1150 cms.

The flood levels and floodplain limits shown on the floodplain mapping sheets are based on a designated flood of 1,050 cms (1:200 year daily) plus a freeboard allowance of 0.6 metres.

6. HYDRAULIC ANALYSIS

6.1 General

The information sources used in Appendix 1 were utilized in the HEC-2 Water Surface Profile Computer Program developed by the Hydrologic Engineering Center, U.S. Army Corps of Engineers. The profile calculations assumed open water flow conditions.

6.2 Cross-Section Plot Run

A computer plot of the river cross-sections was obtained to assess the river cross-section data input and the extentions of the sections obtained from the existing topographic mapping in the study area. Output from the plot run was also used to review the flow regime, loss coefficients, bridge information, reach lengths, overbank information and relative Manning's "n" values.

6.3 Model Calibration

The calibrated Manning's "n" value for the river channel in the study area averaged 0.029 based on the stage discharge data for the river gauge at Quick (08EE004) for a number of flows varying from 63 cms. to 1150 cms.

Observed level data for the 63 cms. flow was also obtained at all river cross-sections during the survey (September 25 to 27, 1985) and averaged to within 0.13 metres of the calculated levels. Calculated levels at the river gauge averaged to within 0.10 metres of the stage discharge gauge data obtained from Environment Canada (Appendix 1.8). Water surface profiles for the study area are shown in Figure 2.

6.4 Sensitivity Analysis

An increase in flow of 20 percent above the 1:200 year daily flow of 1050 cms. results in an average water level increase in the model area of 0.38 metres, which is within the freeboard allowance (0.60 metres).

Studies indicate that an increase in channel Mannings's "n" values of 20% to 0.035 results in an average water level increase of 0.44 metres for the 1:200 year daily flow of 1050 cms., which is within the freeboard allowance.

6.5 Ice Levels

The 1:200 year flood levels (freeboard included) was approximately equal to the 1984 ice levels immediately upstream of the bridge at Quick. Evidence of ice levels (date unknown) located between cross-sections 17 and 18, approximately 350 metres upstream of the bridge at Quick, indicate that ice levels exceed the 1:200 year flood levels (freeboard included) by as much as 0.75 metres.

Evidence of ice levels (date unknown) was also obtained between cross-sections 20 and 21 (scar on tree bark). Ice levels in this vicinity exceeded the 1:200 year flood level (freeboard included) by approximately 0.90 metres.

Figure 2 indicates the location and elevation of the above noted ice levels relative to the computed 1:200 year flood levels (freeboard included) in the study area. The 1984 ice jam flood experience at Quick suggests that observed ice levels can be considerably higher than the actual water levels. For the purposes of flood protection ice jam levels are not necessarily relevant in the floodplain fringe, based on the 1984 experience in which there was no significant migration of ice out of the main river channel at Quick.

7. Floodplain Mapping

The flood levels determined in the study, plus freeboard, were used to draw the designated floodplain limits on to the existing 2 metre contour planimetric topographic mapping of the study area.

The attached drawings (Appendix 2) were produced and indicate the following information:

- The floodplain mapping indicates the locations of the river cross-sections, the designated floodplain limits, the flood levels determined in the study, the locations and elevations of survey monuments and the location of the river gauge (08EE004).
- The study extends the existing floodplain mapping for the Bulkley River from Smithers to upstream of Telkwa (32.6 km., Dwg. No. 84-68) a further 11.8 km. to include the Quick area.
- The Bulkley River in the study area has a moderate slope (0.15%).
- The river channel is incised in the study area and is subject to ice jam flooding during winter freeze-up periods.

8. CONCLUSIONS AND RECOMMENDATIONS

1. This report presents an overview of the studies undertaken to produce the floodplain mapping sheets for the Bulkley River, Quick area.
2. The floodplain mapping is deemed to be preliminary as it is based on 2 metre contour mapping.
3. Flood level calculations were based on a standard step modelling technique, which assumes open water flow conditions, and do not reflect problems related to ice jam flooding. The information shown on the floodplain mapping sheets may be used for administrative purposes related to floodproofing requirements in zoning bylaws and subdivision approvals, provided cognizance is taken of the special hazards related to ice jam occurrences.

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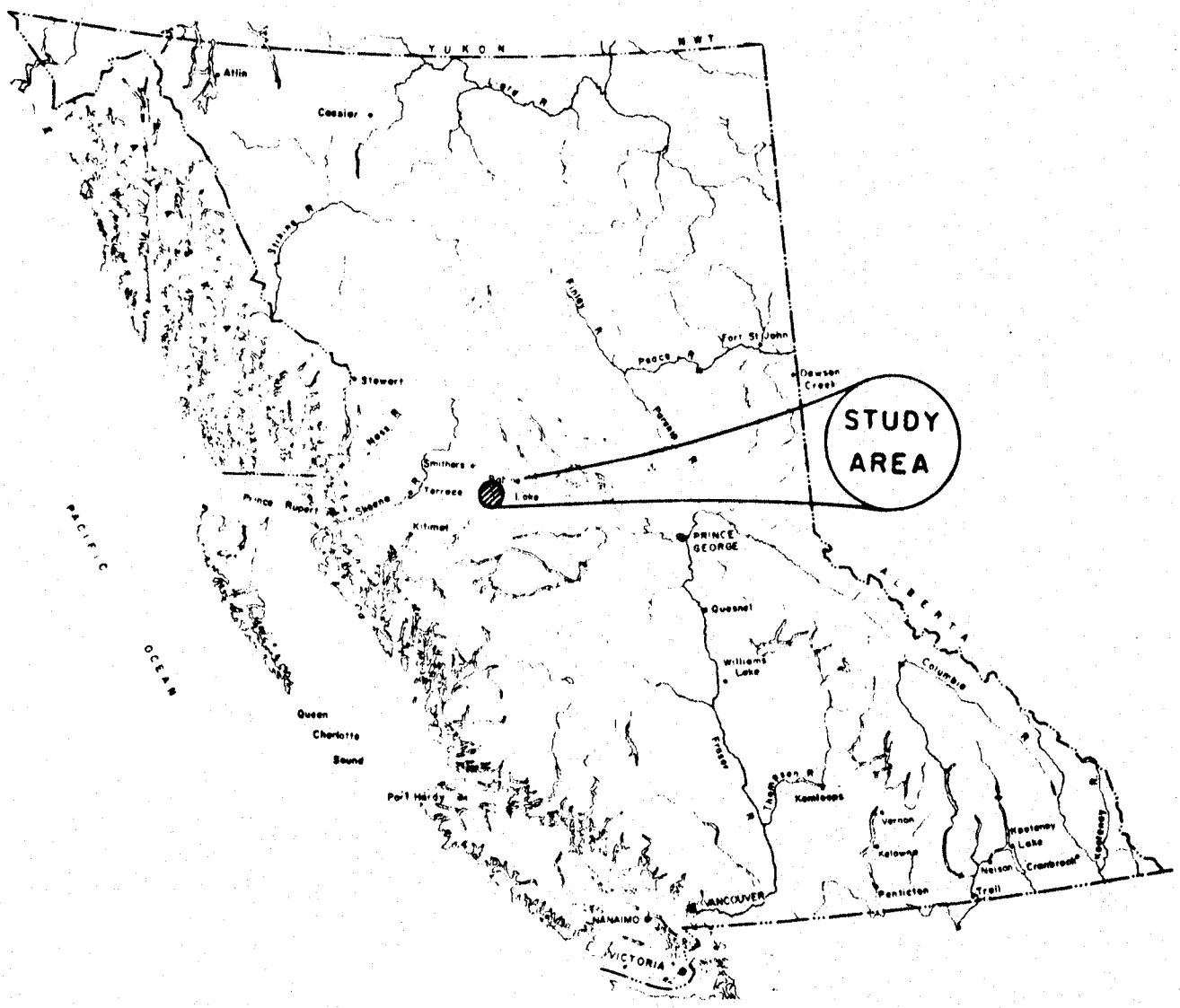
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APPENDIX 1

Detailed Information Sources Used in the Floodplain Mapping Study - Bulkley River, Quick Area

Number	Source	Comments
1.	Atlas of British Columbia, U.B.C. Press W.R. 912.711 F231C.4	General information on the people, environment and resource use.
2.	"The 1984 Quick Flood Bulkley River", by L.E. Garinger and J.B. McGonigal dated January 3, 1985, Smithers, B.C. File P84-1, Rivers Section	A preliminary report to describe the chronology of events regarding the flood which occurred at Quick between December 24 and December 30, 1984.
3.	Memo outlining the ice jam flooding of December, 1984 by B. McMullen, P. Eng., Rivers Section, W.M.B. dated January 9, 1985, File P84-1, Rivers Section	A preliminary analysis and observations and suggestions for further study regarding the December, 1984 ice jam flooding at Quick.
4.	"Bulkley River at Quick, B.C. Assessment of Ice Jam Flooding of December 1984" prepared by N.W. Hydraulic Consultants Limited, dated March , 1985	A report prepared for the Water Management Branch, to review available data and recommend mitigative measures regarding the possible flooding from the 1985 break-up at Quick.
5.	"State of Emergency Follows Water, Sewage Problems", from the Interior News, Smithers, B.C., April 13, 1966	A newspaper article on the ice jam damage and flooding at the Bulkley Highway Bridge in Smithers.
6.	Project No. 85RPP12, September 1985, Surveys Section, Water Management Branch	21 river cross-sections near Quick, B.C. plus residential elevation data, water surface profile, ice mark levels, bridge details, photos at cross sections.
7.	Project No. 82-071, February 1984, Mapping Section, Surveys and Resource Mapping Branch	Planimetric topographic mapping at 1:5000 scale, contour interval 2 metres; date of photography June 1982, 6 sheets.
8.	Memo from Environment Canada dated May 26, 1986, File 2642-1	Stage-discharge data, 08EE004, Bulkley River at Quick.



STUDY AREA LOCATION

Province of British Columbia
Ministry of Environment
WATER MANAGEMENT BRANCH

TO ACCOMPANY REPORT ON

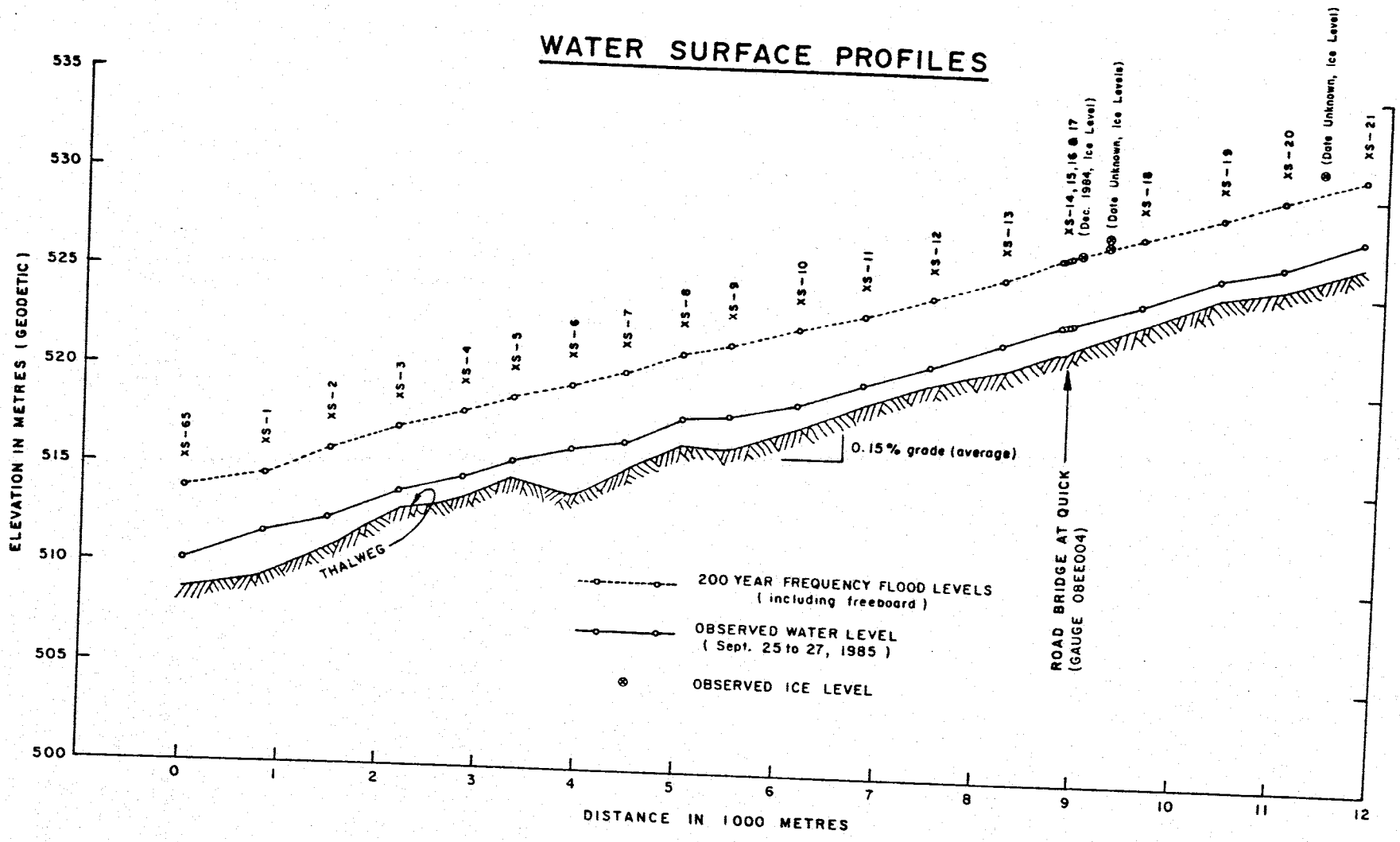
FLOODPLAIN MAPPING STUDY
BULKLEY RIVER – QUICK AREA

SCALE	DATE	ENGINEER
AS SHOWN	JUNE 1986	R. W. NICHOLS

FILE No. 46-000-S.1 FIGURE No. 1

BCIL 7673-M-E

WATER SURFACE PROFILES



Province of British Columbia
Ministry of Environment
Water Management Branch

TO ACCOMPANY REPORT ON
FLOODPLAIN MAPPING STUDY
BULKLEY RIVER - QUICK AREA

SCALE: VERT. AS SHOWN
HOR. AS SHOWN
DATE JUNE 1986
R. W. NICHOLS ENGINEER
FILE No. 46-000-S.1 FIGURE No. 2