KOOTENAY RIVER DISCHARGE

BELOW KOOTENAY LAKE

DEVELOPMENT OF THE DISCHARGE CURVE FOR KOOTENAY RIVER AT GROHMAN, B.C., UNDER PRESENT CONDITIONS

Joint Report

by

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PREFACE

Pursuant to the International Joint Commission Order of Approval dated November 11, 1938, which authorized the excavation of Grohman Narrows, the levels of Kootenay Lake are to be lowered during each flood season by definite minimum amounts below the levels that would have occurred had there been no modification of flow conditions by Corra Linn Dam or channel excavations at Grohman Narrows, i.e., under the outlet conditions of 1929, referred to as the original outlet conditions.

Enforcement of this section of the Order necessitates the computation of the daily mean elevation of Kootenay Lake under natural conditions; that is, the levels that would have existed had they not been affected by the development and operations by the West Kootenay Power and Light Co., Ltd. The computation of these lake levels has been accomplished through use of the Nelson Discharge Curve for Original Conditions and the Storage Diagram as presented in the report, "The Regulation of Kootenay Lake--Development of the Discharge Curve and Storage Diagram for Original Outlet Conditions," dated October 27, 1941, by T. M. Patterson, Ottawa, Ontario, and R. W. Davenport, Washington, D. C. Prior to this report no method of determining outflows from Kootenay Lake had received joint formal acceptance by the United States Geological Survey and the Canadian Water Resources Division. Initially the outflows were determined by deducting intermediate inflow from the discharge measured at Glade. In 1944 the Glade station was drowned out by backwater from Brilliant Dam. In the absence of other independent means of determining outflows, the daily discharges through the Corra Linn Dam and powerhouse, as computed by the

power company, have been used as the outflow from Kootenay Lake as they were readily available and were considered substantially accurate.

Discharge measurements taken at a new cableway at Grohman subsequent to the completion of the Grohman Narrows excavation were used by W. S. Eisenlohr, Jr., Wash., D. C., through application of a multiple correlation procedure, to develop a discharge curve for present conditions that would be effective at least 6 months each year. The purpose of this report therefore is to present:-

(a) the discharge curve for Kootenay River at Grohman, B. C., derived by multiple correlation analysis, which provides an alternative means for computing outflow from Kootenay Lake (as compared to outflows computed by the power company),

(b) an analysis of the effects of the Corra Linn development and related works on the levels of Kootenay Lake and the lowerings achieved, computed on basis of daily discharge obtained by application of the Grohman discharge curve,

(c) a study of operating procedure at Corra Linn Dam during the flood season for control of forebay elevations, consistent with requirements for lake lowerings, that is suited to efficient operation of the Corra Linn plant, and

(d) considerations regarding review of discharge ratings for the gates and wheels at Corra Linn Dam and powerhouse.

Following exchange of correspondence and pertinent technical data the undersigned met and reached mutual agreement regarding the acceptability of the Grohman discharge curve for determining the outflow from Kootenay Lake.

The results of the studies are presented in the following report and are submitted herewith for the information and guidance, as appropriate, of the International Kootenay Lake Board of Control and other agencies concerned.

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Introduction

1. A basic consideration in the control or regulation of storage in Kootenay Lake and the operation of Corra Linn Dam is the amount of outflow from Kootenay Lake. The effect of storage and compliance with the requirements for lowering of lake levels during the flood season are determined by comparing the present observed levels of Kootenay Lake with the computed levels that would have existed had there been no modification of flow conditions by Corra Linn Dam or the channel excavation below Nelson, B. C.

2. In 1941 the Dominion Water and Power Bureau (now Water Resources Division) and the United States Geological Survey adopted a stage-discharge relation for Kootenay River at Nelson, B. C., under original outlet conditions as presented in the joint report by T. M. Patterson and R. W. Davenport entitled "The Regulation of Kootenay Lake--Development of the Discharge Curve and Storage Diagram for Original Outlet Conditions", dated October 27, 1941. This report was the culmination of studies carried out between 1939-41 during which period several reports regarding the discharge of Kootenay River below Kootenay Lake, and Kootenay Lake storage were exchanged between the participating government agencies.

3. Prior to June 1944, when the gaging station at Glade was drowned out by operations at Brilliant Dam, but subsequent to the Grohman Narrows excavation, the outflow from Kootenay Lake used in studies of the effect of regulation of the Lake was determined by the Geological Survey by subtracting, from the discharge measured at the gaging station at Glade, the measured inflow from Slocan River and estimated flow of other tributaries between Corra Linn Dam and Glade. It was considered that this method gave satisfactory flow records at the Corra Linn plant but it was recognized that the flow at that point included unrecorded inflow tributary to the forebay between the natural control at Grohman Narrows and Corra Linn which had not contributed to the supply to the Kootenay Lake under original outlet conditions.

4. Prior to this report no method of determining the outflow from Kootenay Lake under present conditions (either the computed flows through Corra Linn sluiceways and power plant or independent determinations) has received formal joint acceptance by the United States Geological Survey and the Canadian Water Resources Division. As a result of the drowning out of the Glade station in June 1944 the outflow records currently used are those computed by the West Kootenay Power and Light Co., Ltd., operators of Corra Linn Dam. These records are computed by means of curves on the power company drawings F-341 and F-342.

5. As a result of the discontinuance of the gaging station at Glade, and in order to simplify determination of the outflow from Kootenay Lake, there is need for a ready means of computing the discharge from the Lake. The results so obtained would provide an independent check on the data obtained by the power company. The need for a rating independent of the

Corra Linn computations for checking the computed data may be demonstrated by a study of the discharge at Corra Linn as furnished by the West Kootenay Power and Light Company and as determined by the Geological Survey by subtracting inflow between Corra Linn Dam and Glade from the discharge of Kootenay River at Glade. For the period November 1940 to March 1941, for example, the power company figures were substantially more (from 1 to 5 percent) than the computed data, as shown by the following tabulation:

Outflow from Kootenay Lake
(second-foot-days)

Month	Glade minus inflow (USGS)	Corra Linn (WKP&L Co.)
November 1940	273,030	275,620
December	256,110	269,600
January 1941	240,040	251,120
February	234,370	243,260
March 1 - 29	325,570	330,690

Similar consistent differences have been observed at other times. The results of discharge measurements made at Grohman Narrows, with appropriate allowance for inflow between the cableway and Corra Linn Dam, also indicate that the flows reported by the power company are too large. In paragraph 43 hereinafter it is indicated that these excessive flow records at Corra Linn may be traced to sluice ratings based on early Grohman measurements which exceeded actual river flows.

Discharge Curve for Kootenay River at Grohman, B. C., under Present Conditions

Stage-Discharge Relation

General Principles.

6. A new cableway at Grohman put into use in February 1943 provides conditions for satisfactory measurement of discharge. Discharge measurements made previously from an earlier cableway are not considered to be of comparable accuracy. The flows measured at Grohman constitute the actual outflow from Kootenay Lake and do not include inflow between Nelson and Corra Linn.

7. Measurements made at Grohman have been referred to gages installed, in accordance with Section 6 of the International Joint Commission Order of November 11, 1938, at Nelson (Gage No. 10), at the forebay of Corra Linn power plant (Gage No. 17) and at the Tailrace of Corra Linn power plant (Gage No. 18). Although elevations of Kootenay Lake at Queens Bay had been obtained preceding many of the discharge measurements, the referring of the measurements to Queens Bay stages is considered unsatisfactory because of the long distance involved and the effects of wind and power operations; however, approximations are feasible on the basis of mean daily elevations. On basis of the consistent results shown by trial plottings, Gage No. 10 at Nelson was adopted as the base gage for the Grohman measurements and rating study.

8. The feasibility of developing a rating for the Kootenay River at Grohman, B. C., on basis of discharge measurements made from the new cableway at Grohman Narrows was studied by Wm. S. Eisenlohr, Jr., of the Geological Survey staff, Washington, D. C. The results of that study were contained in a memorandum dated Nov. 21, 1946, that was made available to the Canadian Water Resources Division by the Geological Survey. The basic principles of

the present multiple-correlation rating were set forth in that memorandum which has been drawn upon freely for the descriptions in this report. The 1946 rating was based on the 47 discharge measurements then available. The present rating is an extension and refinement made possible by 98 additional measurements.

9. Grohman Narrows acts as a section control at the outlet of Kootenay Lake below Nelson, B. C. Gage heights measured at Nelson give the head on this control. If the sluice gates at Corra Linn Dam 7 miles downstream are opened sufficiently to eliminate backwater at the control, it is possible to establish a simple stage-discharge relation that is applicable for such conditions. This is a free-fall rating. With fewer sluice gates open and backwater present above the control at Grohman the discharge varies with the fall in water surface between Nelson and Corra Linn as well as with the stage at Nelson. A rating under backwater conditions involving stage, fall, and discharge can be obtained by methods used successfully in stream-flow computations elsewhere, which are developments of ordinary multiple correlation procedures (for discussion of multiple correlation, see "Methods of Correlation Analysis" by Mordecai Ezekiel).

10. A multiple-correlation rating consists of several relation curves. The stage-discharge relation curve is basically a limiting curve that is large of all stage-discharge plottings and represents the maximum discharge possible at the given stage. The free-fall curve is a limiting curve that is small of the falls of all measurements plotting on the stage-discharge curve and defines the minimum fall under which free-fall discharge can occur. In the construction of the rating the stage-discharge curve is drawn as a mean of all measurements that have falls greater than the free fall. The adjustment needed to make any other measurements plot on the stage-discharge

curve is a function of the ratio of the observed fall to the free fall. This function is obtained by plotting the ratio of the measured discharge to the free fall discharge against the ratio of the observed fall to the free fall, and drawing a smooth curve through these points. Measurements under backwater are adjusted to equivalent discharge under free-fall conditions by dividing the measured discharge by the function so obtained. The stage-discharge curve is fixed finally as a mean of all measurements made under, or adjusted to, free-fall conditions.

Relation Curves.

11. A listing of the Grohman discharge measurements and pertinent computations is given in Table 1. The plotting of these measurements and the resulting curves are shown on figures 1 and 2 as follows:

a. Gage height at Nelson vs. measured and adjusted discharge

b. Gage height at Nelson vs. fall

c. Fall ratio vs. discharge ratio

In the preliminary studies it was observed that discharge measurements made when the fall was less than 0.4 foot plotted so erratically when adjusted to equivalent free-fall discharge that they have been given little weight in the development of the rating.

12. The plottings of measurements obviously made under free-fall conditions indicate that, as in most natural channels, the control section and reach of river between Nelson and Corra Linn are subject to change. Measurements made subsequent to the flood of 1948 define a change in rating caused apparently by erosion of the banks at Grohman Narrows and deposition of the scoured material at the low water control section. The relation

curves effective before and after the peak of the 1948 flood are as shown in figures 1 and 2.

Point of Zero Flow.

13. The initial studies assumed, in the absence of actual observations, that the effective point of zero flow at Grohman was about at elevation 1,730 feet. Subsequent further study to check the position of the curve of free fall indicated that the point of zero flow is probably at about elevation 1,728 feet (see figure 3, which shows by logarithmic plotting that the relation curves plot more nearly as straight lines when referred to a base of 1,728 ft.).

Datum.

14. In June 1949 a new Nelson gage was placed in operation at approximately the same location as the old gage. Check levels have indicated that the new gage is at the same datum as the gage previously used.

Relation Tables.

15. Measurements 1-80 were made prior to June 12, 1948, and measurements 81-146 were made subsequently. Measurement 86 is incomplete. These measurements, with the exception of those with falls of less than 0.4 foot, define the stage-discharge curves effective prior and subsequent to the 1948 flood. It is evident from the plottings of the measurements that a change in the control occurred at the crest of the flood. Figure 1 shows the plottings of measurements 1-80 as well as the resulting curve for the stage-discharge relation under free fall, the free-fall curve, and the discharge ratio curve. Figure 2 shows similar plottings of measurements

81-85, 87-146 and resulting curves. The measured discharges and, when falls are less than free fall, the adjusted discharges are plotted for use in defining the stage-discharge curve.

16. Tables have been prepared for use in applying the curves to each of the two conditions. These tables consist of (1) the stage-discharge relation under free fall for gage heights at Nelson, (2) the free fall for gage heights at Nelson, and (3) the discharge ratio (J_F) for given fall ratios. The tables for the respective ratings are as follows:

Rating dated August 17, 1951 (effective from 1943 to June 11, 1948)

Table 2. Stage-discharge relation under free fall

3. Free fall

4. Discharge ratio (J_F)

Rating dated August 20, 1951 (effective June 12, 1948 to).

Table 5. Stage-discharge relation under free fall

6. Free fall

7. Discharge ratio (J_F)

For free-fall conditions the discharge table is used directly. With backwater, the correct discharge is obtained by multiplying the free-fall discharge by the discharge ratio (J_F) corresponding to the ratio of the falls.

17. In connection with the development of the free-fall rating, the falls of all measurements were plotted on the same sheet. The position of each of the several relation curves was then determined after careful analysis of those measurements with falls approximating indicated free fall. The positions of the curves as finally selected may be checked by noting that some measurements with greater falls may plot low in discharge as compared to measurements having smaller falls, thus indicating that

discharge was occurring under free fall. It was deduced also that apparently none of the measurements made for gage heights under 42 feet were made under free-fall conditions. As a result of measurements obtained in 1951 these curves were defined more sharply than had been possible previously.

18. Thirty discharge measurements (measurements 9-12, 24-29, 37-39, 50-55, 67, 68, 106, 107, 113-116, 123-125) had falls of less than 0.4 foot and were not used in the rating analyses. Measurement 3 plots 6.9 percent small but is balanced by measurements 41 and 59. Measurement 112, plotting 9.9 percent small, may be affected by regulation resulting from power operations. However, measurement 112 is balanced by measurement 122, plotting 8.0 percent large; the falls for these measurements were small, amounting to 0.45 foot and 0.53 foot, respectively. Measurements 136 and 137 plot 5.1 percent and 4.7 percent small; study of the soundings indicates no noticeable deviation from other measurements. The remaining 109 measurements have measured or adjusted free fall discharges that plot less than 5 percent away from their respective ratings and only 6 deviate more than 4 percent. For measurements made under free-fall conditions the maximum deviation from the curves is only 3.3 percent.

General.

19. It was considered that perhaps the free-fall curves for the two ratings should be parallel. In the absence, however, of specific information regarding the point of zero flow both curves were drawn on the basis of zero flow at elevation 1728.0 feet. It is considered that the effect of any minor change in position of the free-fall curve at the lower stages is not significant.

20. The feasibility of using a composite discharge ratio (J_F) curve was given consideration but in view of the evident change in shape of the control section a composite curve was deemed to be improper and separate curves were derived for each rating.

21. Discharge measurements obtained on the recession from the 1948 flood peak plot small of the rating in the range of stage from 49 feet to 52 feet, indicating the possibility of an intermediate rating. However, analysis of these measurements in comparison with measurements made later or at higher and lower stages support the development of a single post-1948 rating.

22. Strong winds, lag in stage changes throughout the reach, and power plant operations may affect the accuracy of individual measurements. Such effects are accentuated when measurements are referred to the Queens Bay gage. The effect of these factors on average daily discharge is probably negligible.

Computation of Daily Discharge

23. The rating for Kootenay River at Grohman provides a means for computing daily outflow from Kootenay Lake. The figures of daily discharge are obtained by multiplying the free-fall discharge for the daily mean stage at Nelson by the discharge ratio (J_F) corresponding to the ratio of the observed fall (difference between daily mean stage at Nelson and at Corra Linn) to the free fall. When the observed fall exceeds the free fall the discharge ratio is 1.000.

24. Flows obtained by computing the discharges through the sluice gates and turbines at Corra Linn Dam include inflow between Grohman and

Corra Linn and thus may not be directly comparable with the discharges obtained at Grohman. Such inflows are minor for much of the year and direct comparisons then are practicable.

25. At present the Grohman rating is not satisfactory for use in determining the outflows when the fall between Nelson and Corra Linn is less than 0.4 foot. Review of records indicates that during the period 1944 to 1951 the rating could be used as follows (see Table 8):

Water Year	Number of Days Rating Applicable	Water Year	Number of Days Rating Applicable
1944	220	1948	253
1945	204	1949	205
1946	231	1950	197
1947	217	1951(Oct.-July)	228

The discharge for periods when the fall is less than 0.4 foot must be determined from the data computed at Corra Linn Dam; as the inflows are small during these periods (the storage period) the flows at Corra Linn are probably comparable with those at Grohman.

26. In order to compare the discharge as computed by the West Kootenay Power and Light Co., Ltd., with the results obtained by application of the Grohman ratings, the daily discharges have been computed for the following periods:

March 1947 to August 1947

October 1949 to September 1950

March 1951 to July 1951

The detailed computations are presented in Tables 9, 10, and 11 respectively, and include the daily discharge as determined at Corra Linn without adjustment for inflow. The data for the complete 1950 water year were determined to show the comparisons during the storage period.

27. Table 12 summarizes the monthly mean flows, including local inflows, as determined (1) by application of the rating, (2) at Corra Linn and (3) from a combination of the two to represent a practicable composite record. The comparison of the results of (1) and (3) with those from Corra Linn indicate that the Corra Linn discharges are generally higher even with allowance for inflows.

28. A comparison by hydrograph of the outflow from Kootenay Lake for the 1950 water year, as determined at Corra Linn and at Grohman, is presented in figure 4. The results of discharge measurements are shown also.

29. During the appropriate portion of each year the Grohman rating provides a satisfactory and practicable means for computing the outflows from Kootenay Lake. This method could be a means for checking or could provide an alternative to the present procedure of computing outflow by use of the curves for Corra Linn sluice gates and wheels. During the remainder of the year (when falls are less than 0.4 foot) the data as computed at Corra Linn would be used for the present. Pending better definition, if feasible, of the rating under low fall conditions, consideration could be given to the review and improvement of the Corra Linn ratings under those conditions.

Kootenay Lake Levels and Lowerings

30. The report, "Regulation of Kootenay Lake--Development of the Discharge Curve and Storage Diagram for Original Outlet Conditions", by T. M. Patterson and R. W. Davenport, dated October 27, 1941, provides the basis for determining compliance by the power company with Sub-section (6) of Section 2 of the International Joint Commission's Order of Approval of November 11, 1938, regarding the requirements for the lowering of Kootenay Lake during the flood season. The daily discharge computed at Corra Linn has been used, as indicated in paragraph 4, as the outflow from the lake. The data supplied by the company include the local inflow between Nelson and Corra Linn. The Grohman rating, however, provides data on outflow that are directly comparable with those at Nelson under original outlet conditions.

31. In view of the somewhat smaller figures of outflow obtained through application of the Grohman rating, it seems appropriate to determine the computed natural elevations at Queens Bay and the lowerings required on basis of these data. Table 13 presents the computations for the period April 1 to July 31, 1950. Comparative data on total supply, computed natural elevation at Queens Bay and the lowerings required and achieved, obtained from the power company's weekly log sheets, are given in Table 14. Figure 5 shows the comparison of the results. It is noted that the computed natural elevations at Queens Bay, determined from the Grohman data, are as much as 0.8 foot lower than those based on the Corra Linn data. Correspondingly, the required lowerings at Queens Bay are reduced, but only by as much as 0.1 foot. The indicated lowerings, however, still exceeded

those required by substantial amounts. The greatest difference between the lowerings computed from the two sets of data occurred during the period when local inflow between Grohman and Corra Linn was largest, as evidenced by the estimated inflow of 1,200 cubic feet per second on June 13.

32. In connection with studies of the water-surface elevations of Kootenai River in Idaho in relation to regulation of the elevation of Kootenay Lake by Corra Linn Dam and the channel excavation below Nelson, B. C., because the actual Queens Bay stages are still lower than those required by the lowering order, as determined from the recomputed stages under original outlet conditions, a corresponding and proportionate lowering of river stages in Idaho is indicated.

Operation of Corra Linn Dam during the Flood Season

33. Prior to the 1951 flood season the West Kootenay Power and Light Company has generally, if not exclusively, operated Corra Linn dam so that the water levels in the forebay would be at the lowest possible levels during the flood period. Such operation has tended to assure upstream interests that the maximum possible outflows from Kootenay Lake were being maintained.

34. In connection with development of the rating for Kootenay River at Grohman it was observed that the section control at Grohman Narrows at the outlet of Kootenay Lake is effective when the sluice gates at Corra Linn Dam are opened sufficiently. Thus the rate of outflow from Kootenay Lake occurring under free fall is the maximum possible at the given stage, and further lowering of the water level at Corra Linn has no effect in increasing the outflow from the lake.

35. As a result of the method of operation the fall between Nelson and Corra Linn has often exceeded that necessary to provide the maximum outflow. During such periods the reduction in the head available at Corra Linn may have resulted in a reduction in power production.

36. The free fall for present conditions referred to gage heights at Nelson is given in the free-fall table for the rating dated August 20, 1951 (Table 6), effective June 12, 1948. The curve of free fall is a straight line with falls for given Nelson gage heights as follows:

Stage (feet)	Fall (feet)	Stage (feet)	Fall (feet)
1736	3.94	1748	9.82
1738	4.92	1750	10.80
1740	5.90	1752	11.78
1742	6.88	1754	12.76
1744	7.86	1756	13.74
1746	8.84		

37. During the flood season Corra Linn Dam might be operated so as to provide for sufficient gate openings to assure the maximum outflow from Kootenay Lake but without excessive adverse effect on the capacity for power production. Such operation may be feasible by maintaining forebay elevations a reasonable amount (one foot or one-half foot) lower than the levels required to meet free-fall conditions, the additional lowering representing a safety factor covering a margin for error and the possibility of further changes in the Grohman control.

38. The following table presents a schedule of forebay elevations during the flood period designed to maintain a one foot margin.

Stage (feet)		Stage (feet)	
At Nelson	At Corra Linn	At Nelson	At Corra Linn
1744.00	1735.14	1751.00	1738.71
1745.00	1735.65	1752.00	1739.22
1746.00	1736.16	1753.00	1739.73
1747.00	1736.67	1754.00	1740.24
1748.00	1737.18	1755.00	1740.75
1749.00	1737.69	1756.00	1741.26
1750.00	1738.20	1757.00	1741.77

If it were determined that a one-half foot margin is sufficient, the above allowable elevations of Corra Linn forebay can be raised by 0.5 foot.

39. Subsequent to the lowering of Kootenay Lake to elevation 1739.32 on April 1 and prior to the beginning of the flood season the power company has usually operated to provide forebay elevations ranging from levels 2 feet below the Nelson stage in early April to an elevation of 1735.0 feet. The effect of the minor loss of storage space resulting from operations under less than free-fall conditions at this period and until the lake reaches an elevation of about 1744 feet will be dissipated in a short time by the increased discharge which will obtain on return to free fall and as a result of the minor increase in lake level.

40. The Nelson gage (Gage No. 10) has been selected as the base gage in connection with the development and use of the Grohman rating. The Nelson gage is useful also as the base gage for control of Corra Linn operations. A stage relation can be drawn for the Queens Bay--Nelson or Queens Bay---Corra Linn reaches for free-fall conditions. However, because of factors of distance, wind, power operations and lesser slope, a stage-discharge rating would be less sensitive than the Grohman rating. A limited number of discharge measurements annually under essentially free-fall conditions would be helpful as a check on the position of the free-fall curve and the stage-discharge relation under free fall. The period when Kootenay Lake levels are rising probably would provide the best opportunity for such measurements. In the absence of measurements under free fall for Nelson stages under 1742 feet special efforts in March or April to obtain measurements in this range would be justified. Operations at Corra Linn generally in accordance with paragraph 38 will provide opportunity during a brief period each year for measurements at intermediate stages.

Rating of Corra Linn Dam Sluiceways and Wheels

42. Comparison of the outflows from Kootenay Lake for the period November 1940 to March 1941, as computed at Corra Linn Dam, with those determined by subtracting inflow from the recorded flows at Glade indicated that the Corra Linn results were from 1 to 5 percent large. Similar relationships were observed for the periods in 1947, 1950 and 1951 for which daily discharges were computed by application of the Grohman rating.

43. The ratings for the sluice gates in Corra Linn Dam were developed by the power company in 1932. The ratings of the Corra Linn Dam and power plant are discussed briefly on pages 24 and 25 of the report, "Kootenay River Discharge below Kootenay Lake", by T. M. Patterson, dated May 22, 1939. These sluice ratings were developed on basis of measurements obtained at Grohman when all flow was through the sluices (power plant closed). As analysis of the Grohman measurements, presented in Table 4 of that report, indicated that the results of the measurements were higher than the actual flows, it was concluded "that the Board would require * * * a revision of the sluice discharge ratings before adopting a plant rating to give the flow at Corra Linn."

44. In 1939 Messrs. C. E. Webb and T. R. Newell, representing the Dominion Water and Power Bureau and the U. S. Geological Survey respectively, arranged to obtain measurements of the flow through the three units at Corra Linn for the purpose of checking the initial rating curves as developed by the power company in 1932. Fourteen measurements were obtained for each of the wheels during the period June 8 to December 8, 1939. These measurements checked the ratings for wheels 1 and 2 within satisfactory limits but the agreement with the rating for wheel 3 was less favorable.

Following careful review, with consideration of the relatively small errors likely in computing discharge by use of drawings F. 341 and F. 342, the Dominion Water and Power Bureau in 1940 concluded that the curves as presented in the drawings were satisfactory for use in computing the flow through the Corra Linn turbines.

45. The Corra Linn ratings were the subject of a conference on May 27 and 28, 1941, at South Slocan, B. C., attended by Messrs. Newell, Webb, Findale and Campbell at which time model studies for determining trends of coefficients to be applied in the discharge formula for the gates received favorable consideration. Although proposals were made to several hydraulic laboratories, concentration on war work forced postponement of the studies. Subsequent to 1946 the anticipated development of a satisfactory rating for Kootenay River at Grohman gave promise of a practical means for checking the Corra Linn data and further planning for model studies has been deferred pending the outcome of present studies.

46. The Grohman rating, demonstrated as being applicable for much of the year, may provide a means for checking the Corra Linn ratings. It should be recognized, however, that the rating may not be suitable for periods when all the discharge occurs through the wheels as the minimum falls are likely to occur at these times. Accordingly the ratings for the wheels may require a further independent check by means of additional current-meter measurements or other studies. It is believed that the ratings for the sluice gates might be checked by deducting flow through the wheels from the sum of the discharge obtained from the Grohman rating and inflow.

47. Angles and velocity of approach during periods of high discharge may affect the ratings for the respective sluice gates, particularly at opposite ends of the dam, thus making it inadvisable to rate only one gate. Under low flow and high head conditions, however, the effect of velocity of approach probably is negligible. Possibly data for the review of the discharge ratings for different gates can be obtained from the Corra Linn operation records and associated figures of discharge computed at Grohman, or operations at Corra Linn might be planned to provide suitable conditions.

Conclusions

48. On basis of the findings presented in this report it is considered that:

a. The rating developed for the Kootenay River at Grohman, B. C., provides a practicable means for determination of the outflow from Kootenay Lake for at least six months each year, particularly during the flood season. Application of the rating is simple. During the critical season outflow from the lake can be determined readily for use in checking compliance with the requirements for lowering. The rating is acceptable to the United States Geological Survey and to the Canadian Water Resources Division.

b. Computation of the equivalent natural elevations of Kootenay Lake through use of the Grohman rating, in connection with analysis of the effects of operations at Corra Linn and the channel excavation below Nelson, B. C., indicates a lower natural elevation than obtained on basis of the Corra Linn data. However, the corresponding required lowerings also are smaller and past actual lowerings have exceeded the required lowerings.

c. Operations at Corra Linn Dam during the flood season could be modified to permit more efficient operation of the Corra Linn plant. This can be accomplished by maintaining forebay elevations at levels sufficient to provide discharge either under free fall, representing the maximum outflow possible, or sufficient to meet the requirements for lake lowerings, whereas previously forebay elevations had been maintained, by request, at the lowest feasible levels.

d. Following attainment of elevation 1739.32 feet at Queens Bay on April 1 at the end of the storage year, it is possible to operate

Corra Linn forebay above free-fall stages until the lake rises to about elevation 1744 feet, which, though causing slight raising of lake levels, would not result in trespass of the required lowerings during flood stages.

e. Discharge determined through use of the Grohman rating may be helpful in the review of the ratings for the Corra Linn sluice gates.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No.

Washington

District

List of Discharge Measurements for Kootenay River at Grohman, B.C. (New Cableway)

Measurement No	Measurement Date	Gage height Nelson No. 10	Gage height Corra Linn	Fall F	Free Fall F_f	Fall Ratio F/F_f	Measured Discharge Q	Free-Fall Discharge Q_f	Discharge Ratio $J = Q/Q_f$	Discharge Ratio from Fall-Ratio Curve J_F	Adjusted Discharge $Q_{adj} = Q/J_F$	Deviation $(Q_{adj} - Q_f)/Q_f$ %
					8-17-51			Rating 8-17-51				
1	1943 Feb 25	39.64	38.96	0.68	5.53	0.123	10,300	22,600	0.456	0.457	22,500	-0.4
2	26	39.56	38.87	.69	5.49	.126	9,940	22,200	.448	.464	21,400	-3.6
3	Mar 1	39.43	38.73	.70	5.42	.129	9,470	21,700	.436	.470	20,100	-7.4
4	Apr 26	46.37	35.90	10.47	8.76	1.195	59,600	60,600	.484	1.000	59,600	-1.6
5	May 4	45.04	—	9.06	8.12	1.116	51,900	51,900	1.000	1.000	51,900	0.0
6	June 16	48.13	35.96	12.17	9.60	1.268	73,200	73,400	.998	1.000	73,200	-0.3
7	29	49.17	—	9.89	10.11	.978	79,800	81,800	.976	.999	79,900	-2.3
8	July 8	49.93	40.06	9.87	10.46	.944	86,000	88,500	.972	.995	86,400	-2.4
9	Aug 28	45.24	44.95	.26	8.22	.032	9,830	53,200	.185	.179	55,000	—
10	Sept. 9	46.10	—	.25	8.63	.029	9950	58,800	.169	.166	60,000	—
11	Oct. 26	46.99	46.79	.20	9.06	.022	9,950	64,900	.153	.134	74,200	—
12	Dec. 8	45.51	45.27	.24	8.34	.029	9,660	55,000	.176	.166	58,200	—
13	1944 Jan. 15	42.20	41.76	.44	6.76	.065	10,100	35,200	.287	.300	33,700	-4.3
14	18	41.98	41.49	.49	6.65	.074	10,700	34,000	.315	.328	32,600	-4.1
15	Feb. 14	40.20	39.79	.41	5.80	.071	8,240	25,100	.328	.319	25,800	+2.8
16	23	39.54	39.06	.48	5.48	.088	8,080	22,200	.364	.370	21,800	-1.8
17	Apr. 25	37.16	34.62	2.54	4.34	.585	12,100	13,800	.877	.870	13,900	+0.7
18	May 15	40.91	37.97	2.94	6.14	.479	23,000	28,400	.810	.814	28,300	-0.4
19	June 7	45.88	41.32	4.56	8.52	.535	48,700	57,400	.848	.844	57,700	+0.5
20	24	44.44	37.19	7.25	7.83	.926	48,000	48,100	.998	.991	48,400	+0.6
21	July 7	43.52	42.13	1.39	7.39	.188	24,200	42,600	.568	.568	42,600	0.0
22	Aug. 9	43.29	42.63	.66	7.28	.091	15,200	41,200	.369	.379	40,100	-2.7
23	28	43.25	42.80	.45	7.26	.062	12,100	41,000	.295	.290	41,700	+1.7
24	Oct. 29	45.22	45.00	.22	8.21	.027	7,490	53,000	.141	.157	47,700	—
25	Nov. 18	45.09	44.83	.26	8.14	.032	7,470	50,200	.143	.179	41,700	—
26	Dec. 15	44.58	44.31	.27	7.90	.034	7,160	49,000	.146	.187	38,300	—
27	20	44.24	43.97	.27	7.74	.035	7,510	46,900	.160	.191	39,300	—
28	1945 Jan. 8	43.30	43.03	.27	7.28	.037	7,920	41,300	.192	.199	39,800	—
29	Feb. 1	42.02	41.71	.31	6.67	.047	8,550	34,200	.250	.233	36,700	—

[1] Based on daily mean elevations at Nelson and Corra Linn. Corr. by AOW

[2] Computed using vertical velocity curves. Checked by TOM

[2] Not computed when $F < .3$.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. { Washington .... { District ....

List of
Discharge Measurements for
Kootenay River at Grohman, B.C. (New cableway)

Measurement No.	Measurement Date	Gage height Nelson No 10	Gage height Corra Linn	Fall F	Free Fall F_f	Fall Ratio F/F_f	Measured Discharge Q	Free-Fall Discharge Q_f	Discharge Ratio $J = Q/Q_f$	Discharge Ratio from Fall-Ratio Curve J_F	Adjusted Discharge $Q_{adj} = \frac{Q}{J_F}$	Deviation[1] $\frac{Q_{adj} - Q_f}{Q_f}$ %
30	1945 Feb. 26	40.42	39.99	0.43	5.90	0.073	8,840	26,100	0.339	0.325	27,200	+4.2
31	Apr. 24	37.59	36.51	1.08	4.55	.237	9,330	15,100	.618	.627	14,900	-1.3
32	May 20	44.65	38.02	6.63	7.94	.835	47,200	49,400	.956	.972	48,600	-1.6
33	24	44.74	38.01	6.73	7.98	.844	47,000	49,900	.942	.974	48,300	-3.2
34	July 9	46.33	38.56	7.77	8.73	.890	60,200	60,300	.998	.984	61,200	+1.5
35	24	44.48	42.00	2.48	7.85	.316	33,600	48,400	.694	.700	48,000	-0.8
36	Aug. 29	43.30	42.82	.48	7.28	.066	12,800	41,300	.310	.303	42,200	+2.2
37	Oct. 6	45.25	45.00	.25	8.22	.030	8,080	53,200	.152	.171	47,300	—
38	Nov. 26	45.16	44.93	.23	8.18	.028	8,790	52,700	.167	.162	54,200	—
39	1946 Feb. 9	43.34	43.02	.32	7.30	.044	8,830	41,500	.213	.226	39,100	—
40	Mar. 5	41.67	40.79	.88	6.51	.135	15,100	32,300	.467	.482	31,300	-3.1
41	Apr. 8	38.68	34.97	3.71	5.07	.732	18,300	18,800	.973	.935	19,600	+4.3
42	May 2	43.36	34.98	8.38	7.31	1.146	42,100	41,700	1.010	1.000	42,100	+1.0
43	7	45.45	35.01	10.44	8.32	1.255	55,300	54,600	1.013	1.000	55,300	+1.3
44	June 3	52.49	34.97	17.52	11.70	1.497	113,000	113,600	.995	1.000	113,000	-0.5
45	7	52.61	35.02	17.59	11.75	1.495	115,400	114,900	1.004	1.000	115,400	+0.4
46	8	52.58	34.99	17.59	11.74	1.497	116,200	114,600	1.013	1.000	116,200	+1.4
47	18	50.99	36.06	14.93	10.98	1.360	99,500	98,400	1.011	1.000	99,500	+1.1
48	July 5	48.74	38.98	9.76	9.90	.986	77,400	78,300	.989	1.000	77,400	-1.1
49	Aug. 19	43.24	42.19	1.05	7.26	.145	20,800	40,900	.509	.500	41,600	+1.7
50	Sept. 1	43.73	43.46	.27	7.49	.036	9,590	43,900	.218	.195	49,200	—
51	20	45.03	44.66	.37	8.11	.046	12,300	51,800	.237	.233	52,800	—
52	Oct. 9	45.07	44.76	.31	8.14	.038	9,750	52,100	.187	.203	48,000	—
53	Nov. 8	45.14	44.90	.24	8.17	.029	7,700	52,500	.147	.166	46,400	—
54	Dec. 7	45.14	44.90	.24	8.17	.029	9,690	52,500	.185	.166	58,400	—
55	1947 Feb. 7	43.58	43.30	.28	7.42	.038	9,540	43,000	.222	.203	47,000	—
56	18	42.70	41.99	.71	7.00	.101	15,700	38,000	.413	.406	38,700	+1.8
57	Mar. 19	40.05	38.59	1.46	5.72	.255	15,700	24,400	.644	.645	24,400	0.0
[illegible]	Apr. 12	39.36	34.89	4.47	5.30	[illegible]	[illegible]	21,400	.981	.970	21,600	+0.9

1 Not computed when F < .1

Comp. by ARW
Ch'kd by TOM
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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ..... District .....

List of Discharge Measurements for Kootenay River at Grohman, B.C. (New cableway)

Measurement No.	Date	Gage Height Nelson No 10	Gage Height Corra Linn	Fall F	Free Fall F_f	Fall Ratio F/F_f	Measured Discharge Q	Free-Fall Discharge Q_f	Discharge Ratio $J = Q/Q_f$	Discharge Ratio from Fall-Ratio Curve J_f	Adjusted Discharge $Q_{adj} = Q/J_f$	Deviation $(Q_{adj} - Q)/Q$ %
	1947											
59	Apr. 16	39.45	34.98	4.47	5.44	0.822	21,900	21,800	1.004	0.968	22,600	+3.7
60	May 17	51.13	34.88	16.25	11.04	1.472	99,200	99,800	.994	1.000	99,200	−0.6
61	21	50.20	34.96	15.24	10.60	1.438	92,400	90,900	1.017	1.000	92,400	+1.7
62	June 3	50.14	35.43	14.71	10.57	1.392	91,800	90,400	1.016	1.000	91,800	+1.5
63	July 22	44.74	37.15	7.59	7.98	.951	48,100	49,900	.964	.996	48,300	−3.2
64	Aug 5	43.17	41.53	1.64	7.23	.227	25,300	40,600	.623	.616	41,100	+1.2
65	Oct 8	44.84	44.02	.82	8.02	.102	21,500	50,500	.426	.408	52,700	+4.4
66	24	44.68	38.30	6.38	7.95	.803	48,000	49,600	.968	.962	49,900	+0.6
67	Dec. 11	45.06	44.79	.27	8.13	.033	9620	52,000	.185	.183	52,600	—
	1948											
68	Feb. 11	43.02	42.72	.30	7.15	.042	9,530	39,700	.240	.218	43,700	—
69	Apr. 6	39.00	37.90	1.10	5.22	.211	12,000	20,000	.600	.597	20,100	+0.5
70	May 11	43.48	35.50	7.98	7.37	1.083	42,500	42,400	1.002	1.000	42,500	+0.2
71	June 2	54.94	34.14	20.80	12.87	1.616	140,000	140,000	1.000	1.000	140,000	0.0
72	3	55.41	34.54	20.87	13.09	1.594	146,000	145,000	1.007	1.000	146,000	+0.7
73	4	55.79	34.92	20.87	13.28	1.572	150,000	150,000	1.000	1.000	150,000	0.0
74	5	56.10	35.16	20.94	13.43	1.560	152,000	153,000	.993	1.000	152,000	−0.7
75	6	56.30	35.32	20.98	13.52	1.552	155,000	155,000	1.000	1.000	155,000	0.0
76	7	56.53	35.36	21.17	13.63	1.552	158,000	158,000	1.000	1.000	158,000	0.0
77	8	56.64	35.58	21.06	13.69	1.538	161,000	159,000	1.012	1.000	161,000	+1.3
78	9	56.64	35.70	20.94	13.69	1.530	161,000	159,000	1.012	1.000	161,000	+1.3
79	10	56.95	36.16	20.79	13.83	1.502	163,000	163,000	1.000	1.000	163,000	0.0
80	11	56.88	35.99	20.89	13.80	1.513	163,000	162,000	1.006	1.000	163,000	+0.6
					Shoal			Rating 8-20-51				
81	12	56.83	35.91	20.92	14.15	1.478	165,000	165,000	1.000	1.000	165,000	0.0
82	14	56.53	35.69	20.84	14.00	1.489	161,000	161,000	1.000	1.000	161,000	0.0
83	15	56.30	35.55	20.75	13.89	1.494	159,000	159,000	1.000	1.000	159,000	0.0
84	16	56.00	35.28	20.72	13.74	1.508	155,000	155,000	1.000	1.000	155,000	0.0
85	17	55.64	35.00	20.64	13.56	1.522	154,000	151,000	1.020	1.000	154,000	+2.0
86	18	55.25	34.67	20.58	13.38	1.538	Meas incomplete					
87	19	54.85	34.31	20.54	13.18	1.558	143,000	142,000	1.007	1.000	143,000	+0.7
88	21	54.04	33.96	20.08	12.77	1.570	132,000	133,000	.992	1.000	132,000	−0.8

1 Not computed when $F < .4$

Comp. by Pow-TOM

Checked by TOM-Pow

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. (Washington ..... District .....

List of Discharge Measurements for

Kootenay River at Grohman, BC. (New cableway)

Measurement No.	Measurement Date	Gage height Nelson No. 10	Gage height Corra Linn	Fall F	Free Fall F_f	Fall Ratio F/F_f	Measured Discharge Q	Free-Fall Discharge Q_f	Discharge Ratio $J = Q/Q_f$	Discharge Ratio from Fall-Ratio Curve J_F	Adjusted Discharge $Q_{adj} = Q_F$	Deviation $\frac{Q_{adj} - Q}{Q_f}$ %
	1988											
89	June 22	53.68	34.01	19.67	12.60	1.561	128,000	129,000	0.992	1.000	128,000	-0.8
90	23	53.32	33.99	19.33	12.43	1.555	127,000	126,000	1.008	1.000	127,000	+0.8
91	24	52.97	34.05	18.92	12.26	1.543	121,000	122,000	.991	1.000	121,000	-0.8
92	25	52.64	33.99	18.65	12.09	1.543	119,000	118,000	1.008	1.000	119,000	+0.8
93	26	52.22	34.48	17.74	11.89	1.492	114,000	114,000	1.000	1.000	114,000	0.0
94	28	51.64	35.56	16.08	11.60	1.386	108,000	108,000	1.000	1.000	108,000	0.0
95	29	51.33	36.04	15.29	11.45	1.335	104,000	105,000	.990	1.000	104,000	-1.0
96	30	51.01	37.05	13.96	11.29	1.237	101,000	102,000	.990	1.000	101,000	-1.0
97	July 1	50.72	37.10	13.62	11.15	1.222	96,400	99,200	.972	1.000	96,400	-2.8
98	2	50.44	38.06	12.38	11.02	1.123	94,700	96,500	.982	1.000	94,700	-1.9
99	3	50.18	39.06	11.12	10.89	1.021	92,000	94,100	.978	1.000	92,000	-2.2
100	4	49.93	39.99	9.94	10.76	.924	87,500	91,400	.952	.981	89,700	-2.9
101	5	49.64	41.00	8.64	10.62	.813	82,900	89,300	.928	.948	87,400	-2.1
102	6	49.41	40.95	8.46	10.51	.805	82,900	87,200	.951	.946	87,600	+0.5
103	8	48.84	41.01	7.83	10.23	.765	79,500	82,100	.968	.934	85,100	+3.7
104	9	48.48	40.95	7.53	10.05	.749	74,100	78,800	.940	.928	79,800	+1.3
105	Aug. 5	43.92	41.03	2.89	7.82	.370	35,300	46,500	.759	.762	46,300	-0.4
106	Oct. 7	45.06	44.67	.39	8.38	.047	12,800	53,700	.238	.248	51,600	—
107	Dec. 7	43.74	43.44	.30	7.73	.039	9,970	45,400	.220	.216	46,100	—
	1989											
108	Feb. 8	39.03	38.52	.51	5.42	.094	7,710	20,000	.386	.401	19,200	-4.0
109	Apr. 5	37.73	36.78	.95	4.78	.199	8,500	14,100	.603	.601	14,100	0.0
110	May 23	50.58	36.00	14.58	11.08	1.316	99,500	97,800	1.017	1.000	99,500	+1.7
111	June 7	49.83	42.08	7.75	10.72	.723	83,600	91,000	.919	.919	91,000	0.0
112	Aug. 9	44.43	43.98	.45	8.07	.056	12,600	49,700	.254	.281	44,800	-9.9
113	10	44.74	44.52	.22	8.22	.027	10,200	51,600	.198	.165	61,800	—
114	Sept. 12	46.99	46.72	.27	9.33	.029	10,500	66,900	.157	.175	60,000	—
115	Oct. 11	46.98	46.78	.20	9.32	.021	8,740	66,900	.131	.135	64,800	—
116	Dec. 6	47.08	46.85	.23	9.37	.025	9,810	67,600	.145	.155	63,300	—
117	1990 Apr. 4	38.44	35.04	3.40	5.11	.661	15,[illegible]	17,300	.913	.847	17,600	+17

1 Not computed when $F \leq .4$

Comp. by Tom

Checked by Area

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington .... District ....

List of Discharge Measurements for

Kootenay River at Grohman, B.C. (New Cableway)

Measurement No.	Date	Gage height Nelson No. 10	Gage height Corra Linn	Fall F	Free Fall F_f	Fall Ratio F/F_f	Measured Discharge Q	Free Fall Discharge Q_f	Discharge Ratio $J = Q/Q_f$	Discharge Ratio from Fall-Ratio Curve J_F	Adjusted Discharge $Q_{adj} = Q/J_F$	Deviation[1] $\frac{Q_{adj} - Q_f}{Q_f}$ %	
118	1950 May 18	45.07	35.18	9.89	8.38	1.180	54,700	53,800	1.017	1.000	54,700	+1.7	
119	June 13	49.36	34.98	14.38	10.49	1.371	87,800	86,700	1.013	1.000	87,800	+1.3	
120	28	54.18	35.00	19.18	12.85	1.493	134,000	135,000	.992	1.000	134,000	-0.7	
121	Aug. 1	45.29	38.03	7.26	8.50	.854	54,800	55,200	.993	.960	57,100	+3.4	
122	Oct. 10	46.93	46.40	.53	9.30	.057	20,400	66,500	.307	.284	71,800	+8.0	US
123	Nov. 10	46.95	46.63	.32	9.30	.034	14,600	66,600	.219	.196	74,500	—	W
124	Dec. 5	47.11	46.86	.25	9.38	.027	12,300	67,900	.181	.165	74,600	—	US
125	1951 Feb. 3	44.85	44.67	.18	8.28	.022	11,600	52,400	.221	.140	82,900	—	W
126	27	42.06	40.32	1.74	6.91	.252	23,500	35,700	.658	.665	35,300	-1.1	US
127	Apr. 10	39.56	34.98	4.58	5.68	.806	21,400	22,700	.943	.946	22,600	-0.4	US
128	May 4	42.68	34.99	7.69	7.21	1.067	40,300	39,200	1.028	1.000	40,300	+2.8	W
129	8	44.26	36.48	7.78	7.99	.974	48,800	48,600	1.004	.996	49,000	+0.8	W
130	10	45.86	37.19	8.67	8.77	.989	58,010	59,100	.982	.999	58,100	-1.7	US
131	11	46.62	37.60	9.02	9.14	.987	63,820	64,300	.992	.998	63,900	-0.6	US
132	13	48.38	38.56	9.82	10.01	.981	76,380	78,000	.979	.997	76,600	-1.8	US
133	15	49.69	39.21	10.48	10.64	.985	87,820	89,700	.979	.998	88,000	-1.9	US
134	17	50.47	39.52	10.95	11.03	.993	97,500	96,700	1.008	.999	97,600	+0.9	W
135	21	51.38	40.24	11.14	11.48	.970	104,400	105,800	.987	.995	105,000	-0.8	W
136	25	52.12	40.71	11.41	11.84	.964	106,600	113,200	.942	.993	107,400	-5.1	US
137	28	52.30	40.76	11.54	11.93	.967	108,900	115,000	.947	.994	109,600	-4.7	US
138	June 5	49.51	35.45	14.06	10.56	1.331	90,800	88,100	1.031	1.000	90,800	+3.1	W
139	6	49.16	35.49	13.67	10.39	1.316	87,700	84,900	1.033	1.000	87,700	+3.3	W
140	7	48.82	34.48	14.34	10.22	1.403	84,200	81,900	1.028	1.000	84,200	+2.8	
141	8	48.44	34.49	13.95	10.04	1.389	78,540	78,500	1.001	1.000	78,540	0.0	
142	11	48.56	44.01	4.55	10.09	.451	64,450	79,500	.811	.808	79,700	+0.3	US
143	20	50.94	38.99	11.95	11.26	1.061	[illegible],500	101,400					W
144	20	50.97	39.00	11.97	11.28	1.061	98,670	101,700	.970	1.000	98,670	-3.0	US (2)
145	22	50.90	39.00	11.90	11.22	1.059	97,980	101,000	.970	1.000	97,980	-3.0	US
146	July 12	50.31	43.01	7.30	10.95	.667	84,020	95,300	.882	.899	93,500	-1.9	US

1 Not computed where F < .4

Comp. by TDM

Checked by RCW

U. S. GOVERNMENT PRINTING OFFICE 10—[illegible]

B-210

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

File No. { Washington / Field

Rating table for KOOTENAY RIVER AT GROHMAN, B.C. — FREE-FALL DISCHARGE (New Cableway), from * 1943, to June 11, 1948

Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference
Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.
37.00	13,300	300	39.00	20,000	400	41.00	28,800	500	43.00	39,600	600	45.00	51,600	700
.10	13,600	300	.10	20,400	400	.10	29,300	500	.10	40,200	500	.10	52,300	600
.20	13,900	300	.20	20,800	400	.20	29,800	500	.20	40,700	600	.20	52,900	700
.30	14,200	300	.30	21,200	400	.30	30,300	500	.30	41,300	600	.30	53,600	600
.40	14,500	300	.40	21,600	400	.40	30,800	600	.40	41,900	600	.40	54,200	700
.50	14,800	300	.50	22,000	400	.50	31,400	500	.50	42,500	600	.50	54,900	600
.60	15,100	300	.60	22,400	400	.60	31,900	600	.60	43,100	600	.60	55,500	700
.70	15,400	400	.70	22,800	500	.70	32,500	500	.70	43,700	600	.70	56,200	600
.80	15,800	300	.80	23,300	400	.80	33,000	600	.80	44,300	600	.80	56,800	700
.90	16,100	400	.90	23,700	500	.90	33,600	500	.90	44,900	600	.90	57,500	600
38.00	16,500	300	40.00	24,200	400	42.00	34,100	600	44.00	45,500	600	46.00	58,100	700
.10	16,800	400	.10	24,600	500	.10	34,700	500	.10	46,100	600	.10	58,800	600
.20	17,200	300	.20	25,100	400	.20	35,200	600	.20	46,700	600	.20	59,400	700
.30	17,500	400	.30	25,500	500	.30	35,800	500	.30	47,300	600	.30	60,100	700
.40	17,900	300	.40	26,000	400	.40	36,300	600	.40	47,900	600	.40	60,800	700
.50	18,200	400	.50	26,400	500	.50	36,900	500	.50	48,500	600	.50	61,500	700
.60	18,600	300	.60	26,900	400	.60	37,400	600	.60	49,100	600	.60	62,200	700
.70	18,900	400	.70	27,300	500	.70	38,000	500	.70	49,700	600	.70	62,900	700
.80	19,300	300	.80	27,800	500	.80	38,500	600	.80	50,300	600	.80	63,600	700
.90	19,600	400	.90	28,300	500	.90	39,100	500	.90	50,900	700	.90	64,300	700

The above table is not applicable for ice or obstructed channel conditions. It is based on 59 discharge measurements made during the period 1943 to June 1948, when fall was in excess of 0.4 ft

and is well defined between second-feet and second-feet.

Gage height referred to Gage No. 10 at Nelson, B.C.

* Measurements subsequent to Feb. 25, 1943; effective subsequent to stabilization of channel at Grohman Narrows following excavation

Add 1,700.00 feet to obtain elevation above mean sea level (G.S.C. 1928 datum)

Computed by Now

Checked by TOM

Date August 17, 1951

Sheet 1 of 2

March, 1915

U. S. GOVERNMENT PRINTING OFFICE 6—7347

9-210

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

File No. { Washington
Field

Rating table for KOOTENAY RIVER AT GROHMAN, B.C. — FREE-FALL DISCHARGE (New Cableway), from ..., 1943, to June 11, 1948

Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference
Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.
47.00	65,000	700	49.00	80,400	800	51.00	98,500	1,000	53.00	119,000	1,000	55.00	140,500	1,100
.10	65,700	700	.10	81,200	900	.10	99,500	1,000	.10	120,000	1,100	.10	141,600	1,200
.20	66,400	700	.20	82,100	800	.20	100,500	1,000	.20	121,100	1,000	.20	142,800	1,100
.30	67,100	800	.30	82,900	900	.30	101,500	1,000	.30	122,100	1,100	.30	143,900	1,200
.40	67,900	700	.40	83,800	800	.40	102,500	1,000	.40	123,200	1,000	.40	145,100	1,100
.50	68,600	800	.50	84,600	900	.50	103,500	1,000	.50	124,200	1,100	.50	146,200	1,200
.60	69,400	700	.60	85,500	900	.60	104,500	1,000	.60	125,300	1,000	.60	147,400	1,100
.70	70,100	800	.70	86,400	900	.70	105,500	1,000	.70	126,300	1,100	.70	148,500	1,200
.80	70,900	700	.80	87,300	900	.80	106,500	1,000	.80	127,400	1,000	.80	149,700	1,100
.90	71,600	800	.90	88,200	900	.90	107,500	1,000	.90	128,400	1,100	.90	150,800	1,200
48.00	72,400	800	50.00	89,100	900	52.00	108,500	1,000	54.00	129,500	1,100	56.00	152,000	1,100
.10	73,200	800	.10	90,000	900	.10	109,500	1,100	.10	130,600	1,100	.10	153,100	1,200
.20	74,000	800	.20	90,900	1,000	.20	110,600	1,000	.20	131,700	1,100	.20	154,300	1,100
.30	74,800	800	.30	91,900	900	.30	111,600	1,100	.30	132,800	1,100	.30	155,400	1,200
.40	75,600	800	.40	92,800	1,000	.40	112,700	1,000	.40	133,900	1,100	.40	156,600	1,100
.50	76,400	800	.50	93,800	900	.50	113,700	1,100	.50	135,000	1,100	.50	157,700	1,200
.60	77,200	800	.60	94,700	1,000	.60	114,800	1,000	.60	136,100	1,100	.60	158,900	1,100
.70	78,000	800	.70	95,700	900	.70	115,800	1,100	.70	137,200	1,100	.70	160,000	1,200
.80	78,800	800	.80	96,600	1,000	.80	116,900	1,000	.80	138,300	1,100	.80	161,200	1,100
.90	79,600	800	.90	97,600	900	.90	117,900	1,100	.90	139,400	1,100	.90	162,300	1,200
												57.0	163,500	

The above table is not applicable for ice or obstructed channel conditions. It is based on ..... discharge measurements made during .....

and is ..... well defined between ..... second-feet and ..... second-feet.

Computed by AOW

Checked by TOM

Sheet 2 of 2

Date August 17, 1951

March, 1915

U. S. GOVERNMENT PRINTING OFFICE 6—7347

9-280

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TABLE 3

File No. | Washington | District

FREE-FALL TABLE.

Kootenay River at Grohman, B.C. —— For Rating dated August 17, 1951

Gage Height*	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9		Difference for 0.1 ft.
1736	3.78	3.83	3.88	3.92	3.97	4.02	4.07	4.12	4.16	4.21		0.048
37	4.26	4.31	4.36	4.40	4.45	4.50	4.55	4.60	4.64	4.69		
38	4.74	4.79	4.84	4.88	4.93	4.98	5.03	5.08	5.12	5.17		
39	5.22	5.27	5.32	5.36	5.41	5.46	5.51	5.56	5.60	5.65		
1740	5.70	5.75	5.80	5.84	5.89	5.94	5.99	6.04	6.08	6.13		
41	6.18	6.23	6.28	6.32	6.37	6.42	6.47	6.52	6.56	6.61		
42	6.66	6.71	6.76	6.80	6.85	6.90	6.95	7.00	7.04	7.09		
43	7.14	7.19	7.24	7.28	7.33	7.38	7.43	7.48	7.52	7.57		
44	7.62	7.67	7.72	7.76	7.81	7.86	7.91	7.96	8.00	8.05		
1745	8.10	8.15	8.20	8.24	8.29	8.34	8.39	8.44	8.48	8.53		
46	8.58	8.63	8.68	8.72	8.77	8.82	8.87	8.92	8.96	9.01		
47	9.06	9.11	9.16	9.20	9.25	9.30	9.35	9.40	9.44	9.49		
48	9.54	9.59	9.64	9.68	9.73	9.78	9.83	9.88	9.92	9.97		
49	10.02	10.07	10.12	10.16	10.21	10.26	10.31	10.36	10.40	10.45		
1750	10.50	10.55	10.60	10.64	10.69	10.74	10.79	10.84	10.88	10.93		
51	10.98	11.03	11.08	11.12	11.17	11.22	11.27	11.32	11.36	11.41		
52	11.46	11.51	11.56	11.60	11.65	11.70	11.75	11.80	11.84	11.89		
53	11.94	11.99	12.04	12.08	12.13	12.18	12.23	12.28	12.32	12.37		
54	12.42	12.47	12.52	12.56	12.61	12.66	12.71	12.76	12.80	12.85		
1755	12.90	12.95	13.00	13.04	13.09	13.14	13.19	13.24	13.28	13.33		
56	13.38	13.43	13.48	13.52	13.57	13.62	13.67	13.72	13.76	13.81		.048
57	13.86											

Rating effective from 1943 to June 11, 1953

Computed by: RSW

* Gage heights at Nelson, B.C. (Gage No. 10)

Checked by: TOM

Date: Aug. 27, 1951

U. S. GOVERNMENT PRINTING OFFICE 30—[illegible]-1

9-210

J_F CURVE

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

File No. { Washington ... / Field ...

Rating table for discharge ratios (J_F) for Kootenay River at Grohman, B.C.

from — , 1943, to June 11, 1948

~~Gage height~~ F/F_f* ~~Feet~~	Discharge Ratio	Difference	~~Gage height~~ F/F_f ~~Feet~~	Discharge Ratio	Difference	~~Gage height~~ F/F_f ~~Feet~~	Discharge Ratio	Difference	~~Gage height~~ F/F_f ~~Feet~~	Discharge Ratio	Difference	~~Gage height~~ F/F_f ~~Feet~~	Discharge Ratio	Difference
0.000	0.000	0.070	0.200	0.584	0.012	0.400	0.764	0.007	0.600	0.877	0.005	0.800	0.961	0.003
.010	.070	.055	.210	.596	.012	.410	.771	7	.610	.882	5	.810	.964	3
.020	.125	.046	.220	.608	.011	.420	.778	7	.620	.887	5	.820	.967	3
.030	.171	.040	.230	.619	.011	.430	.785	6	.630	.892	5	.830	.970	3
.040	.211	.037	.240	.630	.010	.440	.791	6	.640	.897	5	.840	.973	3
.050	.248	.035	.250	.640	.010	.450	.797	6	.650	.902	4	.850	.976	2
.060	.283	.033	.260	.650	.010	.460	.803	6	.660	.906	4	.860	.978	2
.070	.316	.031	.270	.660	.009	.470	.809	6	.670	.910	4	.870	.980	2
.080	.347	.029	.280	.669	.009	.480	.815	6	.680	.914	4	.880	.982	2
.090	.376	.027	.290	.678	.009	.490	.821	6	.690	.918	4	.890	.984	2
.100	.403	.025	.300	.687	.008	.500	.827	5	.700	.922	4	.900	.986	2
.110	.428	.023	.310	.695	.008	.510	.832	5	.710	.926	4	.910	.988	2
.120	.451	.021	.320	.703	.008	.520	.837	5	.720	.930	4	.920	.990	2
.130	.472	.019	.330	.711	.008	.530	.842	5	.730	.934	4	.930	.992	2
.140	.491	.018	.340	.719	.008	.540	.847	5	.740	.938	4	.940	.994	2
.150	.509	.017	.350	.727	.008	.550	.852	5	.750	.942	4	.950	.996	1
.160	.526	.016	.360	.735	.008	.560	.857	5	.760	.946	4	.960	.997	1
.170	.542	.015	.370	.743	.007	.570	.862	5	.770	.950	4	.970	.998	1
.180	.557	.014	.380	.750	.007	.580	.867	5	.780	.954	4	.980	.999	1
.190	.571	.013	.390	.757	.007	.590	.872	5	.790	.958	3	.990	1.000	0
												1.000	1.000	

The above table is not applicable for ice or obstructed channel conditions. It is based on .... discharge measurements made during ....

and is .... well defined between .... second-feet and .... second-feet.

* Fall Ratio

J_F = Discharge ratio from fall ratio - discharge ratio curve.

J_F = 1.00 when $F/F_f > 1.00$

Computed by AOW

Checked by TOM

Date August 17, 1951

March, 1915

G. S. GOVERNMENT PRINTING OFFICE 6—7347

TABLE 5 1 of 2

9-210

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

File No. Washington
Field

Rating table for KOOTENAY RIVER AT GROHMAN, B.C. — FREE-FALL DISCHARGE
(New Cableway), from June 12, 1948, to ....., 19....

Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference
Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.
37.00	11,200	400	39.00	19,900	500	41.00	30,000	600	43.00	41,000	600	45.00	53,300	700
.10	11,600	400	.10	20,400	500	.10	30,600	500	.10	41,600	600	.10	54,000	700
.20	12,000	400	.20	20,900	500	.20	31,100	500	.20	42,200	600	.20	54,700	600
.30	12,400	400	.30	21,400	500	.30	31,600	600	.30	42,800	600	.30	55,300	700
.40	12,800	400	.40	21,900	500	.40	32,200	500	.40	43,400	600	.40	56,000	700
.50	13,200	400	.50	22,400	500	.50	32,700	500	.50	44,000	600	.50	56,700	600
.60	13,600	400	.60	22,900	500	.60	33,200	600	.60	44,600	600	.60	57,300	700
.70	14,000	400	.70	23,400	500	.70	33,800	500	.70	45,200	600	.70	58,000	700
.80	14,400	500	.80	23,900	500	.80	34,300	500	.80	45,800	600	.80	58,700	600
.90	14,900	400	.90	24,400	500	.90	34,800	600	.90	46,400	600	.90	59,300	700
38.00	15,300	500	40.00	24,900	500	42.00	35,400	500	44.00	47,000	600	46.00	60,000	700
.10	15,800	400	.10	25,400	500	.10	35,900	600	.10	47,600	600	.10	60,700	700
.20	16,200	500	.20	25,900	500	.20	36,500	600	.20	48,200	700	.20	61,400	700
.30	16,700	400	.30	26,400	500	.30	37,100	500	.30	48,900	600	.30	62,100	700
.40	17,100	500	.40	26,900	500	.40	37,600	600	.40	49,500	600	.40	62,800	700
.50	17,600	400	.50	27,400	500	.50	38,200	600	.50	50,100	700	.50	63,500	700
.60	18,000	500	.60	27,900	500	.60	38,800	500	.60	50,800	600	.60	64,200	700
.70	18,500	400	.70	28,400	500	.70	39,300	600	.70	51,400	600	.70	64,900	700
.80	18,900	500	.80	28,900	500	.80	39,900	600	.80	52,000	700	.80	65,600	700
.90	19,400	500	.90	29,400	600	.90	40,500	500	.90	52,700	600	.90	66,300	700

The above table is not applicable for ice or obstructed channel conditions. It is based on 56 discharge measurements made ~~during~~ subsequent to the peak of the 1948 flood (when fall was in excess of 0.4 ft.)

and is ..... well defined ~~between~~ throughout ~~second feet and~~ ..... ~~second feet.~~

Gage height referred to Gage No. 10 at Nelson, B.C.

Add 1,700.00 feet to obtain elevation above mean sea level (G.S.C. 1928 datum)

Computed by TOM
Checked by AOW
Date August 20, 1951

Sheet 1 of 2

March, 1915

U. S. GOVERNMENT PRINTING OFFICE 16-7847

T.S 2 of 2

9-210

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

File No. Washington
Field

Rating table for KOOTENAY RIVER AT GROHMAN, B.C. — FREE-FALL DISCHARGE
(New Cableway), from June 12, 1948, to ____, 19____

Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference	Gauge height	Discharge	Difference
Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.	Feet	Sec.-ft.	Sec.-ft.
47.00	67,000	800	49.00	83,500	900	51.00	102,000	1,000	53.00	122,000	1,100	55.00	144,000	1,100
.10	67,800	800	.10	84,400	900	.10	103,000	1,000	.10	123,100	1,100	.10	145,100	1,100
.20	68,600	800	.20	85,300	900	.20	104,000	1,000	.20	124,200	1,100	.20	146,200	1,100
.30	69,400	800	.30	86,200	900	.30	105,000	1,000	.30	125,300	1,100	.30	147,300	1,100
.40	70,200	800	.40	87,100	900	.40	106,000	1,000	.40	126,400	1,100	.40	148,400	1,100
.50	71,000	800	.50	88,000	900	.50	107,000	1,000	.50	127,500	1,100	.50	149,500	1,100
.60	71,800	800	.60	88,900	900	.60	108,000	1,000	.60	128,600	1,100	.60	150,600	1,100
.70	72,600	800	.70	89,800	900	.70	109,000	1,000	.70	129,700	1,100	.70	151,700	1,100
.80	73,400	800	.80	90,700	900	.80	110,000	1,000	.80	130,800	1,100	.80	152,800	1,100
.90	74,200	800	.90	91,600	900	.90	111,000	1,000	.90	131,900	1,100	.90	153,900	1,100
48.00	75,000	800	50.00	92,500	900	52.00	112,000	1,000	54.00	133,000	1,100	56.00	155,000	1,200
.10	75,800	800	.10	93,400	900	.10	113,000	1,000	.10	134,100	1,100	.10	156,200	1,200
.20	76,600	800	.20	94,300	900	.20	114,000	1,000	.20	135,200	1,100	.20	157,400	1,200
.30	77,400	800	.30	95,200	900	.30	115,000	1,000	.30	136,300	1,100	.30	158,600	1,200
.40	78,200	800	.40	96,100	900	.40	116,000	1,000	.40	137,400	1,100	.40	159,800	1,200
.50	79,000	800	.50	97,000	1,000	.50	117,000	1,000	.50	138,500	1,100	.50	161,000	1,200
.60	79,900	900	.60	98,000	1,000	.60	118,000	1,000	.60	139,600	1,100	.60	162,200	1,200
.70	80,800	900	.70	99,000	1,000	.70	119,000	1,000	.70	140,700	1,100	.70	163,400	1,200
.80	81,700	900	.80	100,000	1,000	.80	120,000	1,000	.80	141,800	1,100	.80	164,600	1,200
.90	82,600	900	.90	101,000	1,000	.90	121,000	1,000	.90	142,900	1,100	.90	165,800	1,200
												57.00	167,000	

The above table is not applicable for ice or obstructed channel conditions. It is based on _____ discharge measurements made during _____

and is _____ well defined between _____ second-feet and _____ second-feet.

Computed by JCM

Checked by AEW

Sheet 2 of 2

Date August 20, 1951

March, 1915

S-7847

9-230

TABLE 6

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. { Washington / District

FREE-FALL TABLE

Kootenay River at Grohman, B.C. ——— For Rating dated August 20, 1951

Gage* Height	0.0	.1	.2	.3	.4	.5	.6	.7	.8	.9		Difference per 0.1 ft.
1736	3.94	3.99	4.04	4.09	4.14	4.18	4.23	4.28	4.33	4.38		0.049
37	4.43	4.48	4.53	4.58	4.63	4.68	4.72	4.77	4.82	4.87		
38	4.92	4.97	5.02	5.07	5.12	5.16	5.21	5.26	5.31	5.36		
39	5.41	5.46	5.51	5.56	5.61	5.66	5.70	5.75	5.80	5.85		
40	5.90	5.95	6.00	6.05	6.10	6.14	6.19	6.24	6.29	6.34		
1741	6.39	6.44	6.49	6.54	6.59	6.64	6.68	6.73	6.78	6.83		
42	6.88	6.93	6.98	7.03	7.08	7.12	7.17	7.22	7.27	7.32		
43	7.37	7.42	7.47	7.52	7.57	7.62	7.66	7.71	7.76	7.81		
44	7.86	7.91	7.96	8.01	8.06	8.10	8.15	8.20	8.25	8.30		
45	8.35	8.40	8.45	8.50	8.55	8.60	8.64	8.69	8.74	8.79		
1746	8.84	8.89	8.94	8.99	9.04	9.08	9.13	9.18	9.23	9.28		
47	9.33	9.38	9.43	9.48	9.53	9.58	9.62	9.67	9.72	9.77		
48	9.82	9.87	9.92	9.97	10.02	10.06	10.11	10.16	10.21	10.26		
49	10.31	10.36	10.41	10.46	10.51	10.56	10.60	10.65	10.70	10.75		
50	10.80	10.85	10.90	10.95	11.00	11.04	11.09	11.14	11.19	11.24		
1751	11.29	11.34	11.39	11.44	11.49	11.54	11.58	11.63	11.68	11.73		
52	11.78	11.83	11.88	11.93	11.98	12.02	12.07	12.12	12.17	12.22		
53	12.27	12.32	12.37	12.42	12.47	12.52	12.56	12.61	12.66	12.71		
54	12.76	12.81	12.86	12.91	12.96	13.00	13.05	13.10	13.15	13.20		
55	13.25	13.30	13.35	13.40	13.45	13.50	13.54	13.59	13.64	13.69		
1756	13.74	13.79	13.84	13.89	13.94	13.98	14.03	14.08	14.13	14.18		.049
57	14.23											

Rating effective June 12, 1948 —

Computed by: TOM

* Gage Heights at Nelson, B.C. (Gage No. 10)

Checked by: (illegible)

Date: Aug. 28, 1951

U. S. GOVERNMENT PRINTING OFFICE 16—44731-3

TABLE 7

9-210

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES BRANCH

File No. {Washington. / Field.....

J_F CURVE

Rating table for discharge ratios (J_F) for Kootenay River at Grohman, B.C.

....., from June 12, 1948, to ....., 19.....

* F/Ff	Discharge Ratio	Difference	F/Ff	Discharge Ratio	Difference	F/Ff	Discharge Ratio	Difference	F/Ff	Discharge Ratio	Difference	F/Ff	Discharge Ratio	Difference
0.000	0.000	0.070	0.200	0.607	0.014	0.400	0.780	0.006	0.600	0.874	0.004	0.800	0.944	0.003
.010	.070	.060	.210	.616	.013	.410	.786	6	.610	.878	4	.810	.947	3
.020	.130	.050	.220	.629	.012	.420	.792	6	.620	.882	4	.820	.950	3
.030	.180	.040	.230	.641	.011	.430	.798	5	.630	.886	4	.830	.953	3
.040	.220	.040	.240	.652	.011	.440	.803	5	.640	.890	3	.840	.956	3
.050	.260	.035	.250	.663	.010	.450	.808	5	.650	.893	4	.850	.959	3
.060	.295	.035	.260	.673	.010	.460	.813	5	.660	.897	3	.860	.962	3
.070	.330	.030	.270	.683	.009	.470	.818	5	.670	.900	4	.870	.965	3
.080	.360	.030	.280	.692	.009	.480	.823	5	.680	.904	3	.880	.968	3
.090	.390	.027	.290	.701	.009	.490	.828	5	.690	.907	4	.890	.971	3
.100	.417	.025	.300	.710	.008	.500	.833	5	.700	.911	3	.900	.974	3
.110	.442	.023	.310	.718	.009	.510	.838	4	.710	.914	4	.910	.977	3
.120	.465	.021	.320	.726	.008	.520	.842	4	.720	.918	3	.920	.980	3
.130	.486	.020	.330	.734	.007	.530	.846	4	.730	.921	4	.930	.983	3
.140	.506	.019	.340	.741	.007	.540	.850	4	.740	.925	3	.940	.986	3
.150	.525	.017	.350	.748	.007	.550	.854	4	.750	.928	4	.950	.989	3
.160	.542	.016	.360	.755	.007	.560	.858	4	.760	.932	3	.960	.992	3
.170	.558	.015	.370	.762	.006	.570	.862	4	.770	.935	3	.970	.995	2
.180	.573	.015	.380	.768	.006	.580	.866	4	.780	.938	3	.980	.997	2
.190	.588	.014	.390	.774	.006	.590	.870	4	.790	.941	3	.990	.999	1
												1.000	1.000	

The above table is not applicable for ice or obstructed channel conditions. It is based on ..... discharge measurements made during .....

and is ..... well defined between ..... second-feet and ..... second-feet.

* Fall Ratio

J_F = Discharge ratio from fall ratio-discharge ratio curve.

J_F = 1.00 when $F/F_f \geq 1.00$

Computed by TDM

Checked by RCW

Date August 20, 1951

March, 1915

U. S. GOVERNMENT PRINTING OFFICE 0—7947

9-330

TABLE 8

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. | Washington
District

KOTENAY RIVER — NUMBER OF DAYS FALL BETWEEN NELSON AND CORRA LINN EXCEEDS 0.4 FEET

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Yr.
1943	—	—	7	—	17	31	30	31	30	31	21	0	
1944	0	0	0	9	23	31	30	31	30	31	30	5	220
1945	1	0	0	0	20	31	30	31	30	31	30	0	204
1946	2	0	0	0	24	31	30	31	30	31	31	21	231
1947	2	0	1	5	16	31	30	31	30	31	31	9	217
1948	31	19	2	2	13	31	30	31	30	31	31	2	253
1949	0	0	1	21	21	31	30	31	30	31	9	0	205
1950	0	2	3	0	12	31	30	31	30	30	23	5	197
1951	13	11	9	17	25	31	30	31	30	31			

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. -- Daily Mean Discharge, March 1947

Day	Gage Height Nelson No.10	Gage Height Corra Linn No.17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m		Discharge at Corra Linn Q_p**
1	42.07	41.38	0.69	6.69	0.103	34,500	0.410	14,100			14,600
2	41.96	41.27	.69	6.64	.104	33,900	.413	14,000			14,330
3	41.86	41.06	.80	6.59	.121	33,400	.453	15,100			15,190
4	41.70	40.75	.95	6.52	.146	32,500	.502	16,300			15,960
5	41.60	40.77	.83	6.47	.128	31,900	.468	14,900			14,510
6	41.55	40.90	.65	6.44	.101	31,600	.406	12,800			12,820
7	41.50	40.91	.59	6.42	.092	31,400	.381	12,000			12,240
8	41.42	40.80	.62	6.38	.097	30,900	.395	12,200			12,300
9	41.34	40.74	.60	6.34	.095	30,500	.390	11,900			12,260
10	41.20	40.27	.93	6.28	.148	29,800	.505	15,100			15,080
11	40.88	39.23	1.65	6.12	.270	28,200	.660	18,600			19,070
12	40.63	38.78	1.85	6.00	.308	27,000	.693	18,700			19,490
13	40.51	38.84	1.67	5.94	.281	26,400	.670	17,700			18,600
14	40.36	38.85	1.51	5.87	.257	25,800	.647	16,700			16,650
15	40.30	39.05	1.25	5.84	.214	25,500	.601	15,300			15,550
16	40.22	39.15	1.07	5.81	.184	25,200	.563	14,200			14,030
17	40.24	39.34	.90	5.82	.155	25,300	.518	13,100			12,930
18	40.14	39.04	1.10	5.77	.191	24,800	.572	14,200			14,040
19	40.00	38.35	1.65	5.70	.289	24,200	.677	16,400	15,700		17,320
20	39.82	37.56	2.26	5.61	.403	23,400	.766	17,900			20,120
21	39.96	38.30	1.66	5.68	.292	24,000	.680	16,300			16,180
22	39.61	35.38	4.23	5.51	.768	22,400	.949	21,300			23,090
23	39.55	34.98	4.57	5.48	.834	22,200	.971	21,600			22,800
24	39.54	34.96	4.58	5.48	.836	22,200	.972	21,600			22,790
25	39.54	34.94	4.60	5.48	.839	22,200	.973	21,600			22,820
26	39.52	34.97	4.55	5.47	.832	22,100	.971	21,500			22,560
27	39.49	35.00	4.49	5.46	.822	22,000	.968	21,300			22,560
28	39.44	34.95	4.49	5.43	.827	21,800	.969	21,100			22,760
29	39.38	34.96	4.42	5.40	.818	21,500	.966	20,800			22,100
30	39.33	34.93	4.40	5.37	.820	21,300	.967	20,600			21,460
31	39.32	34.99	4.33	5.37	.806	21,300	.963	20,500			21,770
						Total		524,400			548,020
						Mean		17,080			17,680

* From rating dated Aug. 7, 1951.

** Computed by W.K.P.&L. Co.

U. S. GOVERNMENT PRINTING OFFICE

S-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ..... District .....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, April 1947

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m	+ Inflow (Est.)	Discharge at Corra Linn Q_p**
1	39.30	34.96	4.34	5.36	0.810	21,200	0.964	20,400			21,790
2	39.35	34.98	4.37	5.38	.812	21,400	.965	20,700			21,980
3	39.41	34.94	4.47	5.41	.826	21,600	.969	20,900			22,240
4	39.45	34.97	4.48	5.43	.825	21,800	.968	21,100			22,260
5	39.50	34.96	4.54	5.46	.832	22,000	.971	21,400			22,540
6	39.52	34.99	4.53	5.47	.828	22,100	.969	21,400			22,530
7	39.51	34.99	4.52	5.46	.827	22,000	.969	21,300			22,470
8	39.48	34.94	4.54	5.45	.833	21,900	.971	21,300			22,490
9	39.43	34.95	4.48	5.42	.827	21,700	.969	21,000			22,130
10	39.36	34.96	4.40	5.39	.816	21,400	.966	20,700			22,150
11	39.37	34.93	4.44	5.40	.822	21,500	.968	20,800			22,010
12	39.35	34.94	4.41	5.38	.820	21,400	.967	20,700	21,000		20,870
13	39.33	34.94	4.39	5.37	.818	21,300	.966	20,600			21,010
14	39.30	35.02	4.28	5.36	.799	21,200	.961	20,400			21,500
15	39.36	35.00	4.36	5.39	.809	21,400	.964	20,600			22,550
16	39.46	35.00	4.46	5.44	.820	21,800	.967	21,100	21,900	260	22,440
17	39.62	35.02	4.60	5.52	.833	22,500	.971	21,900			23,110
18	39.82	35.04	4.78	5.61	.852	23,400	.976	22,800			23,550
19	40.04	34.98	5.06	5.72	.885	24,400	.983	24,000			25,340
20	40.35	34.95	5.40	5.86	.922	25,800	.990	25,500			28,820
21	40.70	35.02	5.68	6.04	.940	27,300	.994	27,100			28,780
22	41.01	34.97	6.04	6.18	.977	28,800	.999	28,800			30,440
23	41.25	34.97	6.28	6.30	.997	30,000	1.000	30,000			31,640
24	41.44	35.00	6.44	6.39	1.+	31,000	1.000	31,000			32,760
25	41.59	34.97	6.62	6.46	1.+	31,800	1.000	31,800			33,500
26	41.72	35.03	6.69	6.53	1.+	32,600	1.000	32,600			34,360
27	41.90	34.97	6.93	6.61	1.+	33,600	1.000	33,600			34,930
28	42.19	34.99	7.20	6.76	1.+	35,200	1.000	35,200			37,240
29	42.61	34.98	7.63	6.95	1.+	37,500	1.000	37,500			39,120
30	43.16	35.02	8.14	7.22	1.+	40,500	1.000	40,500			41,080
						Total		754,700			797,630
						Mean		25,220			26,540

From rating dated Aug. 17, 1931

* Computed by W.K.P.&L. Co.

+ Inflow between Grohman Narrows and Corra Linn Dam.

U. S. GOVERNMENT PRINTING OFFICE 16-38729-1

9-250

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, May 1947.

Day	Gage Height Nelson No.10	Gage Height Corra Linn No.17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m	Inflow + (Est.)	Discharge at Corra Linn Q_p**
1	43.70	35.04	8.66	7.68	1.+	43,700	1.000	43,700			44,920
2	44.14	34.99	9.15	7.69	1.+	46,300	1.000	46,300			48,970
3	44.50	34.98	9.52	7.86	1.+	48,500	1.000	48,500			52,450
4	44.87	34.98	9.89	8.04	1.+	50,700	1.000	50,700			54,730
5	45.29	35.01	10.28	8.24	1.+	53,500	1.000	53,500			57,850
6	45.81	35.06	10.75	8.48	1.+	56,900	1.000	56,900			60,890
7	46.36	35.09	11.27	8.75	1.+	60,500	1.000	60,500			65,860
8	47.01	35.09	11.92	9.06	1.+	65,100	1.000	65,100			70,100
9	47.75	35.09	12.66	9.42	1.+	70,500	1.000	70,500			76,500
10	48.48	35.09	13.39	9.77	1.+	76,200	1.000	76,200			81,750
11	49.20	35.04	14.16	10.12	1.+	82,100	1.000	82,100			88,300
12	49.84	34.96	14.88	10.42	1.+	87,700	1.000	87,700			93,200
13	50.42	34.94	15.48	10.70	1.+	93,000	1.000	93,000			99,350
14	50.85	34.93	15.92	10.90	1.+	97,100	1.000	97,100			103,690
15	51.10	34.94	16.16	11.03	1.+	99,500	1.000	99,500			105,550
16	51.16	34.89	16.27	11.06	1.+	100,100	1.000	100,100			105,840
17	51.13	34.86	16.27	11.04	1.+	99,800	1.000	99,800	99,200		105,410
18	50.96	34.90	16.06	10.96	1.+	98,100	1.000	98,100			104,290
19	50.73	34.85	15.88	10.85	1.+	96,000	1.000	96,000			101,430
20	50.45	34.86	15.59	10.71	1.+	93,300	1.000	93,300			98,770
21	50.18	34.89	15.29	10.59	1.+	90,700	1.000	90,700	92,400	320	45,950
22	49.95	34.88	15.07	10.48	1.+	88,600	1.000	88,600			94,540
23	49.74	34.92	14.82	10.38	1.+	86,800	1.000	86,800			92,450
24	49.57	34.88	14.69	10.29	1.+	85,200	1.000	85,200			90,960
25	49.48	34.91	14.57	10.25	1.+	84,400	1.000	84,400			90,530
26	49.49	34.97	14.52	10.26	1.+	84,500	1.000	84,500			90,210
27	49.63	34.98	14.65	10.32	1.+	85,800	1.000	85,800			91,240
28	49.72	34.97	14.75	10.37	1.+	86,600	1.000	86,600			91,940
29	49.81	34.97	14.84	10.40	1.+	87,400	1.000	87,400			92,700
30	49.91	34.98	14.93	10.45	1.+	88,300	1.000	88,300			93,460
31	49.93	34.94	14.90	10.46	1.+	88,500	1.000	88,500			93,730
						Total		2,475,700			2,637,560
						Mean		79,850			85,020

* From rating table Aug 17, 1951.

** Computed by W.R.P.A.C.

+ Inflow between Grohman Narrows and Corra Linn Dam.

U. S. GOVERNMENT PRINTING OFFICE 16—57175-1

DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, June 1947

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m		Discharge at Corra Linn Q_p**	
1	49.99	34.98	15.01	10.50	1.+	89,000	1.000	89,000			94,300	
2	50.05	35.14	14.91	10.52	1.+	89,600	1.000	89,600			94,920	
3	50.11	35.40	14.71	10.55	1.+	90,100	1.000	90,100	91,800		96,410	
4	50.20	35.47	14.73	10.60	1.+	90,900	1.000	90,900			96,360	
5	50.30	35.60	14.70	10.64	1.+	91,900	1.000	91,900			97,670	
6	50.35	35.65	14.70	10.66	1.+	92,400	1.000	92,400			98,010	
7	50.35	35.67	14.68	10.66	1.+	92,400	1.000	92,400			98,200	
8	50.31	35.65	14.66	10.64	1.+	92,000	1.000	92,000			97,920	
9	50.28	35.61	14.67	10.63	1.+	91,700	1.000	91,700			97,640	
10	50.34	35.72	14.62	10.66	1.+	92,300	1.000	92,300			98,150	
11	50.36	35.73	14.63	10.67	1.+	92,400	1.000	92,400			98,370	
12	50.36	35.70	14.66	10.67	1.+	92,400	1.000	92,400			98,690	
13	50.37	35.71	14.66	10.67	1.+	92,500	1.000	92,500			98,780	
14	50.37	35.72	14.65	10.67	1.+	92,500	1.000	92,500			98,730	
15	50.33	35.69	14.64	10.65	1.+	92,200	1.000	92,200			98,470	
16	50.20	35.74	14.41	10.60	1.+	90,900	1.000	90,900			96,190	
17	50.05	36.00	14.05	10.52	1.+	89,600	1.000	89,600			95,000	
18	49.90	36.03	13.87	10.45	1.+	88,200	1.000	88,200			93,730	
19	49.74	36.51	13.23	10.38	1.+	86,800	1.000	86,800			90,860	
20	49.55	37.01	12.54	10.28	1.+	85,000	1.000	85,000			89,580	
21	49.35	37.05	12.30	10.18	1.+	83,400	1.000	83,400			87,910	
22	49.13	37.05	12.08	10.08	1.+	81,500	1.000	81,500			85,570	
23	48.92	37.02	11.90	9.98	1.+	79,800	1.000	79,800			83,320	
24	48.71	37.04	11.67	9.88	1.+	78,100	1.000	78,100			81,770	
25	48.49	37.03	11.46	9.77	1.+	76,300	1.000	76,300			80,180	
26	48.31	37.05	11.26	9.68	1.+	74,900	1.000	74,900			78,800	
27	48.18	37.08	11.10	9.63	1.+	73,800	1.000	73,800			77,910	
28	48.06	37.06	11.00	9.57	1.+	72,900	1.000	72,900			76,930	
29	47.90	37.03	10.87	9.49	1.+	71,600	1.000	71,600			75,660	
30	47.74	37.02	10.72	9.42	1.+	70,400	1.000	70,400			73,720	
						Total		2,517,500			2,730,250	
						Mean		83,920			91,010	

* From rating dated Aug. 17, 1951.
** Computed by W.K.P.E.L.Co.

U. S. GOVERNMENT PRINTING OFFICE 16—43701-3

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ..... District .....

KOOTENAY RIVER AT GROHMAN, B.C. -- Daily Mean Discharge, July 1947

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f *	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m		Discharge at Corra Linn Q_p **	
1	47.57	37.03	10.54	9.33	1.+	69,200	1.000	69,200			71,990	
2	47.34	37.05	10.34	9.24	1.+	67,800	1.000	67,800			70,690	
3	47.21	37.06	10.15	9.16	1.+	66,500	1.000	66,500			69,280	
4	47.07	37.14	9.93	9.09	1.+	65,500	1.000	65,500			67,770	
5	46.92	37.10	9.82	9.02	1.+	64,400	1.000	64,400			66,710	
6	46.76	37.06	9.70	8.95	1.+	63,300	1.000	63,300			65,590	
7	46.65	37.03	9.62	8.89	1.+	62,600	1.000	62,600			64,580	
8	46.52	37.02	9.50	8.83	1.+	61,600	1.000	61,600			63,740	
9	46.41	37.15	9.26	8.77	1.+	60,900	1.000	60,900			62,170	
10	46.30	37.04	9.26	8.72	1.+	60,100	1.000	60,100			62,240	
11	46.17	37.06	9.11	8.66	1.+	59,200	1.000	59,200			61,350	
12	46.04	37.23	8.81	8.60	1.+	58,400	1.000	58,400			59,370	
13	45.95	37.34	8.61	8.56	1.+	57,800	1.000	57,800			59,980	
14	45.84	37.14	8.70	8.50	1.+	57,100	1.000	57,100			59,360	
15	45.72	37.07	8.65	8.45	1.+	56,300	1.000	56,300			57,690	
16	45.65	37.14	8.51	8.41	1.+	55,800	1.000	55,800			56,590	
17	45.51	37.09	8.42	8.34	1.+	55,000	1.000	55,000			55,890	
18	45.38	37.10	8.28	8.28	1.000	54,100	1.000	54,100			54,840	
19	45.26	37.08	8.18	8.23	.994	53,300	1.000	53,300			53,970	
20	45.12	37.11	8.01	8.16	.982	52,400	.999	52,300			53,170	
21	44.94	37.08	7.86	8.07	.974	51,700	.998	51,100			51,540	
22	44.79	37.08	7.71	8.00	.965	50,700	.998	50,100	48,100		50,910	
23	44.63	37.11	7.52	7.92	.949	49,300	.996	49,100			49,500	
24	44.42	37.05	7.37	7.82	.942	48,000	.994	47,700			47,960	
25	44.29	37.15	7.14	7.75	.921	47,200	.990	46,700			46,670	
26	44.07	37.17	6.90	7.65	.902	45,900	.986	45,300			46,440	
27	43.87	37.04	6.83	7.56	.904	44,700	.987	44,100			44,420	
28	43.68	37.07	6.61	7.47	.885	43,600	.983	42,900			43,090	
29	43.58	37.09	6.49	7.42	.875	43,000	.981	42,200			42,400	
30	43.43	37.06	6.37	7.34	.868	42,100	.980	41,300			41,560	
31	43.21	36.98	6.23	7.24	.860	40,800	.978	39,900			40,350	
						Total		1701.300			1,741,850	
						Mean		54,890			56,190	

* From rating dated Aug. 17, 1951

** Computed by W.K.P.F.L.Co

U. S. GOVERNMENT PRINTING OFFICE 16—40721-3

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, August 1947

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m	Inflow+ (Est.)	Discharge at Corra Linn Q_p**
1	43.06	37.06	6.00	7.17	0.837	40,000	0.972	38,900			39,420
2	42.89	37.02	5.87	7.09	.828	39,000	.969	37,800			38,420
3	42.73	37.06	5.67	7.01	.809	38,200	.964	36,800			37,500
4	42.73	39.02	3.71	7.01	.529	38,200	.842	32,200			30,120
5	43.16	41.53	1.63	7.22	.226	40,500	.615	24,900	25,300	75	25,300
6	43.25	41.96	1.29	7.26	.178	41,000	.554	22,700			22,360
7	43.29	42.12	1.17	7.27	.161	41,200	.528	21,800			21,280
8	43.29	42.09	1.20	7.27	.165	41,200	.534	22,000			21,180
9	43.33	42.16	1.17	7.29	.160	41,500	.526	21,800			21,000
10	43.33	42.15	1.18	7.29	.162	41,500	.529	22,000			21,300
11	43.29	42.08	1.21	7.27	.166	41,200	.536	22,100			21,540
12	43.24	42.05	1.19	7.26	.164	40,900	.532	21,800			21,040
13	43.23	42.10	1.13	7.25	.156	40,900	.519	21,200			20,480
14	43.19	42.07	1.12	7.23	.155	40,600	.518	21,000			20,290
15	43.17	42.17	1.00	7.22	.138	40,600	.487	19,800			19,120
16	43.16	42.21	.95	7.22	.132	40,500	.476	19,300			18,510
17	43.16	42.26	.90	7.22	.125	40,500	.462	18,700			17,920
18	43.15	42.31	.84	7.21	.117	40,400	.444	17,900			17,080
19	43.24	42.61	.63	7.26	.087	40,900	.367	15,000			14,820
20	43.23	42.60	.63	7.25	.087	40,900	.367	15,000			15,110
21	43.24	42.59	.65	7.26	.090	40,900	.376	15,400			15,590
22	43.24	42.59	.65	7.26	.090	40,900	.376	15,400			15,510
23	43.30	42.71	.59	7.28	.081	41,300	.350	14,500			14,800
24	43.32	42.68	.64	7.29	.088	41,400	.370	15,300			15,730
25	43.35	42.67	.68	7.31	.093	41,600	.384	16,000			15,970
26	43.36	42.64	.72	7.31	.099	41,700	.400	16,700			16,220
27	43.36	42.65	.71	7.31	.097	41,700	.395	16,500			16,350
28	43.36	42.62	.74	7.31	.101	41,700	.406	16,900			16,180
29	43.36	42.63	.73	7.31	.100	41,700	.403	16,800			16,260
30	43.36	42.63	.73	7.31	.100	41,700	.403	16,800			16,270
31	43.51	43.03	.48	7.38	.065	42,600	.300	12,800			11,590
						Total		645,800			634,230
						Mean		20,830			20,460

+ From ratings dated Aug. 17, 1951

++ Computed by W.K.P.&L. Co.

+ Inflow between Grohman Narrows and Corra Linn Dam.

U. S. GOVERNMENT PRINTING OFFICE 16—63731-1

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington .... District ....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, October 1949

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio F/F_f	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m	Inflow+ (Est.)	Discharge at Corra Linn Q_{cl}**
1	47.10	46.93	0.17	9.38	0.018	67,800	0.118	8,000	—	—	9,390
2	47.11	46.93	.18	9.38	.019	67,900	.124	8,420	—	—	9,190
3	47.10	46.94	.16	9.38	.017	67,800	.112	7,590	—	—	9,720
4	47.12	46.95	.17	9.39	.018	68,000	.118	8,020	—	—	9,720
5	47.05	46.80	.25	9.36	.027	67,400	.165	11,100			12,650
6	47.04	46.80	.24	9.35	.026	67,300	.160	10,800			12,710
7	47.04	46.84	.20	9.35	.021	67,300	.135	9,080			11,380
8	47.03	46.84	.19	9.34	.020	67,200	.130	8,740			10,560
9	47.01	46.82	.19	9.33	.020	67,100	.130	8,720			10,340
10	46.97	46.77	.20	9.32	.021	66,800	.135	9,020			10,500
11	46.97	46.78	.19	9.32	.020	66,800	.130	8,680	8,740	50	10,430
12	46.94	46.73	.21	9.30	.023	66,600	.145	9,660	—	—	10,580
13	46.94	46.75	.19	9.30	.020	66,600	.130	8,660	—	—	10,610
14	46.92	46.72	.20	9.29	.022	66,400	.140	9,300	—	—	10,360
15	46.86	46.67	.19	9.26	.021	66,000	.135	8,910			10,430
16	46.82	46.62	.20	9.24	.022	65,700	.140	9,200	—	—	10,340
17	46.82	46.64	.18	9.24	.019	65,700	.124	8,140	—	—	10,440
18	46.89	46.75	.14	9.28	.015	66,200	.100	6,620	—	—	9,310
19	46.77	46.61	.16	9.21	.017	65,400	.112	7,320	—	—	8,860
20	46.73	46.56	.17	9.19	.018	65,100	.118	7,680			8,570
21	46.73	46.56	.17	9.19	.018	65,100	.118	7,680	—	—	8,640
22	46.71	46.53	.18	9.18	.020	65,000	.130	8,450	—	—	8,730
23	46.70	46.53	.17	9.18	.019	64,900	.124	8,040	—	—	8,820
24	46.66	46.46	.20	9.16	.022	64,600	.140	9,040	—	—	9,510
25	46.62	46.41	.21	9.14	.023	64,300	.145	9,320			9,970
26	46.60	46.42	.18	9.13	.020	64,200	.130	8,340	—	—	8,940
27	46.58	46.38	.20	9.12	.022	64,100	.140	8,970	—	—	8,440
28	46.60	46.40	.20	9.13	.022	64,200	.140	8,980	—	—	8,720
29	46.63	46.42	.21	9.14	.023	64,400	.145	9,340	—	—	8,930
30	46.69	46.50	.19	9.18	.021	64,800	.135	8,750	—	—	8,750
31	46.71	46.51	.20	9.18	.022	65,000	.140	9,100			8,840
						Total		264,110			304,430
						Mean		8,520			9,820

* Free rating dated Aug. 20, 1951

** Computed by W.K.P.&L. Co.

*** For composite record + Inflow between Grohman Narrows and Corra Linn Dam.

U. S. GOVERNMENT PRINTING OFFICE 16—4570-1

9-330

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, November 1949

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f^*	Discharge Ratio J_F	Discharge Q_{adj}			Discharge at Corra Linn Q_p**
1	46.73	46.57	0.16	9.19	0.017	65,100	0.112	7,290			8,230
2	46.73	46.58	.15	9.19	.016	65,100	.106	6,900			8,480
3	46.75	46.60	.15	9.20	.016	65,200	.106	6,910			8,190
4	46.76	46.61	.15	9.21	.016	65,300	.106	6,920			8,230
5	46.77	46.61	.16	9.22	.017	65,400	.112	7,320			8,350
6	46.78	46.63	.15	9.22	.016	65,500	.106	6,940			8,150
7	46.79	46.65	.14	9.23	.015	65,500	.100	6,550			8,190
8	46.78	46.64	.14	9.22	.015	65,500	.100	6,550			8,020
9	46.82	46.69	.13	9.24	.014	65,700	.094	6,180			8,050
10	46.82	46.64	.13	9.24	.014	65,700	.094	6,180			7,380
11	46.86	46.72	.14	9.26	.015	66,000	.100	6,600			8,120
12	46.88	46.73	.15	9.27	.016	66,200	.106	7,020			8,040
13	46.92	46.75	.17	9.29	.018	66,400	.118	7,830			9,250
14	46.95	46.81	.14	9.30	.015	66,600	.100	6,660			8,910
15	46.97	46.82	.15	9.32	.016	66,800	.106	7,080			9,530
16	46.99	46.83	.16	9.33	.017	66,900	.112	7,490			10,430
17	46.99	46.83	.16	9.33	.017	66,900	.112	7,490			10,200
18	46.98	46.82	.16	9.32	.017	66,900	.112	7,490			10,070
19	46.93	46.77	.16	9.29	.017	66,500	.112	7,450			10,080
20	46.95	46.79	.16	9.30	.017	66,600	.112	7,460			9,930
21	46.93	46.76	.17	9.29	.018	66,500	.118	7,840			9,870
22	46.93	46.75	.18	9.29	.019	66,500	.124	8,240			9,780
23	46.87	46.66	.21	9.27	.023	66,100	.145	9,580			9,960
24	46.89	46.68	.21	9.28	.023	66,200	.145	9,600			9,940
25	46.89	46.69	.20	9.28	.022	66,200	.140	9,270			9,850
26	46.96	46.76	.20	9.31	.021	66,700	.135	9,000			9,970
27	47.00	46.75	.25	9.33	.027	67,000	.165	11,100			10,980
28	46.91	46.14	.77	9.28	.083	66,400	.369	24,500			23,090
29	46.89	46.26	.63	9.28	.068	66,200	.323	21,400			21,510
30	47.09	46.73	.36	9.38	.038	67,700	.212	14,400			16,750
						Total		244,240			307,530
						Mean		8,140			10,250

* From rating dated Oct. 30, 1951

** Computed by W.K.P.K.L.Co.

For composite record.

U.S. GOVERNMENT PRINTING OFFICE 10—34721-1

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. { Washington ..... / District .....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, December 1949

Day	Gage Height: Nelson No. 10	Gage Height: Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f^*	Discharge Ratio J_c	Discharge Q_{adj}	Measured Discharge q_m	Inflow† (Est.)	Discharge at Corra Linn Q_p **	
1	47.02	46.97	0.55	9.34	0.059	67,200	0.292	19,600			21,470	
2	46.76	45.83	.93	9.21	.101	65,300	.420	27,400			27,650	
3	46.69	46.07	.62	9.18	.068	64,800	.323	20,900			21,170	
4	46.96	46.80	.16	9.31	.017	66,700	.112	7,470			17,210	
5	47.00	46.84	.16	9.33	.017	67,000	.112	7,500			10,280	
6	47.03	46.85	.18	9.34	.019	67,200	.124	8,330	9,810	110	10,590	
7	47.04	46.92	.17	9.38	.018	67,700	.118	7,990			10,370	
8	47.04	46.93	.16	9.38	.017	67,700	.112	7,580			10,310	
9	47.04	46.91	.18	9.38	.019	67,700	.124	8,400			10,350	
10	47.10	46.91	.19	9.38	.020	67,800	.130	8,810			10,520	
11	47.05	46.87	.18	9.35	.019	67,400	.124	8,360			10,180	
12	47.04	46.86	.15	9.35	.016	67,300	.124	8,340			10,230	
13	47.03	46.86	.17	9.34	.018	67,200	.118	7,930			10,790	
14	47.02	46.87	.15	9.34	.016	67,200	.106	7,120			10,520	
15	47.00	46.87	.13	9.33	.014	67,000	.094	6,300			9,340	
16	46.97	46.73	.21	9.32	.023	66,800	.145	9,690			10,460	
17	46.98	46.81	.17	9.32	.018	66,900	.118	7,890			10,470	
18	47.00	46.82	.18	9.33	.019	67,000	.124	8,310			10,130	
19	46.88	46.67	.21	9.27	.023	66,200	.145	9,600			10,640	
20	46.82	46.61	.21	9.24	.023	65,700	.145	9,520			10,540	
21	46.81	46.61	.20	9.23	.022	65,700	.140	9,200			10,210	
22	46.71	46.48	.23	9.18	.025	65,000	.155	10,100			10,530	
23	46.76	46.56	.20	9.21	.022	65,300	.140	9,140			10,240	
24	46.67	46.45	.22	9.17	.024	64,700	.150	9,700			10,350	
25	46.68	46.48	.20	9.17	.022	64,800	.140	9,070			9,870	
26	46.62	46.41	.21	9.14	.023	64,300	.145	9,320			10,180	
27	46.64	46.44	.20	9.15	.022	64,500	.140	9,030			10,300	
28	46.67	46.47	.20	9.17	.022	64,700	.140	9,060			10,230	
29	46.64	46.45	.19	9.15	.021	64,500	.135	8,710			10,140	
30	46.61	46.43	.18	9.13	.020	64,300	.130	8,360			9,940	
31	46.58	46.38	.20	9.12	.022	64,100	.140	8,970			10,240	
						Total		307,700			361,050	358,660
						Mean		9,930			11,650	11,570

* From rating dated Aug. 22, 1951

** Computed by W.K.P.P.L. Co.

For composite record.

† Inflows between Grohman Narrows and Corra Linn Dam

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington / District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, January 1950

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}			Discharge at Corra Linn Q_p**	
1	46.61	46.43	0.18	9.13	0.020	64,300	0.130	8,360			9,830	
2	46.50	46.30	.20	9.08	.022	63,500	.140	8,890			9,440	
3	46.44	46.25	.19	9.06	.021	63,100	.135	8,520			9,600	
4	46.40	46.19	.21	9.04	.023	62,800	.145	9,100			10,260	
5	46.32	46.10	.22	9.00	.024	62,200	.150	9,330			10,470	
6	46.31	46.13	.18	8.99	.020	62,200	.130	8,080			10,170	
7	46.22	46.00	.22	8.95	.025	61,500	.155	9,530			10,380	
8	46.15	45.94	.21	8.92	.024	61,000	.150	9,150			10,140	
9	46.11	45.89	.22	8.89	.025	60,800	.155	9,420			10,100	
10	46.13	45.95	.18	8.90	.020	60,900	.130	7,920			9,950	
11	46.02	45.82	.20	8.85	.023	60,100	.145	8,710			9,630	
12	45.93	45.69	.24	8.80	.027	59,500	.165	9,820			10,230	
13	46.01	45.80	.21	8.84	.024	60,100	.150	9,020			10,060	
14	45.92	45.73	.19	8.80	.022	59,400	.140	8,320			10,110	
15	45.80	45.57	.23	8.74	.026	58,700	.160	9,390			10,270	
16	45.74	45.54	.20	8.71	.023	58,300	.145	8,450			9,470	
17	45.62	45.40	.22	8.65	.025	57,400	.155	8,900			9,740	
18	45.55	45.34	.21	8.62	.024	57,000	.150	8,550			10,050	
19	45.52	45.30	.22	8.61	.026	56,800	.160	9,090			10,060	
20	45.45	45.23	.22	8.58	.026	56,400	.160	9,020			10,460	
21	45.36	45.10	.26	8.53	.030	55,700	.180	10,000			10,480	
22	45.31	45.09	.22	8.50	.026	55,400	.160	8,860			9,890	
23	45.31	45.05	.26	8.50	.031	55,400	.184	10,200			10,920	
24	45.30	45.05	.25	8.50	.029	55,300	.175	9,680			9,540	
25	45.24	45.01	.23	8.47	.027	54,900	.165	9,060			9,470	
26	45.28	45.06	.22	8.49	.026	55,200	.160	8,830			10,010	
27	45.19	44.94	.25	8.45	.030	54,600	.180	9,830			10,210	
28	45.12	44.86	.26	8.41	.031	54,100	.184	9,950			10,580	
29	45.07	44.84	.23	8.39	.027	53,800	.165	8,880			10,270	
30	45.00	44.77	.23	8.35	.028	53,300	.170	9,060			10,200	
31	44.95	44.71	.24	8.32	.029	53,000	.175	9,270			10,130	
						Total		281,190			313,170	
						No. 10		9,070			10,070	

* From rating table Corp. Co. 1951

** Computed by W.R.P.&L. Co.

For composite record.

U. S. GOVERNMENT PRINTING OFFICE 16—54721-1

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. { Washington .... { District ....

Kootenay River at Grohman, B.C. — Daily Mean Discharge, February 1950

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Discharge at Corra Linn Q_p**
1	44.89	44.63	0.26	8.30	0.031	52,600	0.184	9,680	10,060
2	44.81	44.58	.23	8.25	.028	52,100	.170	8,860	10,290
3	44.78	44.56	.22	8.24	.027	51,900	.165	8,560	10,170
4	44.73	44.52	.21	8.21	.026	51,600	.160	8,250	10,150
5	44.68	44.44	.24	8.19	.029	51,300	.175	8,980	10,020
6	44.63	44.40	.23	8.16	.028	51,000	.170	8,670	10,080
7	44.57	44.35	.22	8.14	.027	50,600	.165	8,350	10,140
8	44.50	44.22	.28	8.10	.035	50,100	.200	10,000	11,740
9	44.39	44.04	.35	8.06	.043	49,400	.232	11,500	12,860
10	44.31	43.97	.34	8.01	.042	49,000	.228	11,200	12,900
11	44.21	43.84	.37	7.96	.046	48,300	.244	11,800	12,680
12	44.11	43.74	.37	7.91	.047	47,700	.248	11,800	12,720
13	44.00	43.64	.36	7.86	.046	47,000	.244	11,500	12,630
14	43.91	43.57	.34	7.81	.044	46,500	.236	11,000	12,180
15	43.85	43.51	.34	7.78	.044	46,100	.236	10,900	11,660
16	43.77	43.38	.39	7.75	.050	45,600	.260	11,900	12,570
17	43.68	43.26	.42	7.70	.055	45,100	.278	12,500	13,100
18	43.60	43.19	.41	7.66	.054	44,600	.274	12,200	12,640
19	43.48	43.04	.44	7.61	.058	43,900	.288	12,600	13,030
20	43.40	42.98	.42	7.57	.056	43,400	.281	12,200	12,740
21	43.29	42.88	.41	7.52	.055	42,700	.278	11,900	12,540
22	43.22	42.81	.41	7.48	.055	42,300	.278	11,800	12,270
23	43.14	42.72	.42	7.44	.056	41,800	.281	11,700	12,670
24	43.08	42.65	.43	7.41	.058	41,500	.288	12,000	12,860
25	43.01	42.60	.41	7.37	.056	41,100	.281	11,600	12,710
26	42.93	42.50	.43	7.33	.059	40,600	.292	11,900	12,620
27	42.83	42.34	.49	7.28	.067	40,100	.320	12,800	13,070
28	42.80	42.36	.44	7.27	.061	39,900	.298	11,900	12,700
						Total		308,050	335,850 / 327,950
						Mean		11,000	11,990 / 11,710

* From rating date [illegible]

* Computed by W.K.P.&L.Co.

** For composite record

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

By ... Washington
File No. ...
District ...

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, March 1950

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Qadj.			Discharge at Corra Linn Q_p**	
1	42.64	42.11	0.53	7.19	0.074	34,000	0.342	13,300			15,320	
2	42.53	41.85	.68	7.13	.095	38,400	.404	15,500			15,720	
3	42.42	41.76	.66	7.09	.093	37,700	.398	15,000			15,430	
4	42.33	41.59	.74	7.04	.105	37,200	.430	16,000			15,990	
5	42.26	41.45	.81	7.01	.116	36,900	.456	16,800			16,750	
6	42.05	40.67	1.38	6.90	.200	35,600	.602	21,400			21,230	
7	41.72	39.64	2.08	6.74	.309	33,900	.717	24,300			25,330	
8	41.51	39.20	2.31	6.64	.348	32,800	.747	24,500			26,130	
9	41.38	39.06	2.32	6.58	.353	32,100	.750	24,100			26,070	
10	41.21	39.09	2.12	6.49	.327	31,200	.732	22,800			23,020	
11	41.07	39.58	1.49	6.43	.232	30,400	.643	19,500			19,410	
12	41.04	40.08	.96	6.41	.150	30,200	.525	15,900			15,740	
13	40.98	40.09	.89	6.38	.140	29,900	.506	15,100			15,120	
14	40.85	39.92	.93	6.32	.147	29,200	.519	15,200			15,400	
15	40.73	39.72	1.01	6.25	.162	28,600	.545	15,600			15,790	
16	40.65	39.64	1.01	6.22	.162	28,200	.545	15,400			15,480	
17	40.53	39.05	1.48	6.15	.241	27,600	.653	18,000			18,260	
18	40.26	38.27	1.99	6.03	.330	26,200	.734	19,200			19,600	
19	40.13	38.23	1.90	5.96	.319	25,600	.725	18,600			18,810	
20	39.99	37.75	2.24	5.90	.380	24,800	.768	19,000			19,940	
21	39.79	37.11	2.68	5.80	.462	23,800	.814	19,400			20,390	
22	39.63	36.79	2.84	5.71	.498	23,000	.832	19,100			20,320	
23	39.44	36.37	3.12	5.66	.551	22,400	.854	19,100			20,210	
24	39.35	36.01	3.34	5.58	.599	21,600	.874	18,400			20,040	
25	39.18	35.44	3.74	5.50	.680	20,800	.904	18,800			19,570	
26	39.02	35.01	4.01	5.42	.740	20,000	.925	18,500			18,830	
27	38.90	34.99	3.91	5.36	.729	19,400	.921	17,900			18,630	
28	38.95	36.82	2.13	5.38	.396	19,600	.778	15,200			15,140	
29	38.75	35.04	3.71	5.28	.703	18,700	.912	17,100			18,490	
30	38.63	35.00	3.63	5.22	.695	18,200	.909	16,500			17,690	
31	38.54	35.01	3.53	5.18	.682	17,700	.925	16,100			17,110	
						Total		544,500			551,510	
						Mean		16,120			18,760	

* Free fall, Nelson, Feb. 20, 1951

** Computed by W.K.P. & L. Co.

For composite record.

U. S. GOVERNMENT PRINTING OFFICE 16—43731-1

9-330

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ..... District .....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, April 1950

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m	+ Inflow (Est.)	Discharge at Corra Linn Q_p**
1	38.46	35.00	3.46	5.18	0.672	17,400	0.901	15,700			16,670
2	38.44	35.00	3.44	5.14	.669	17,300	.900	15,600			16,500
3	38.42	35.00	3.42	5.13	.667	17,200	.899	15,500			16,410
4	38.42	35.01	3.41	5.13	.665	17,200	.898	15,400	15,800	90	16,430
5	38.41	35.01	3.40	5.12	.664	17,200	.898	15,400			16,510
6	38.35	35.02	3.33	5.10	.653	16,900	.894	15,100			16,190
7	38.35	35.02	3.33	5.10	.653	16,900	.894	15,100			16,270
8	38.31	35.01	3.30	5.07	.651	16,700	.893	14,900			16,050
9	38.30	35.02	3.28	5.07	.647	16,700	.892	14,900			15,940
10	38.30	35.01	3.29	5.07	.644	16,700	.893	14,900			16,120
11	38.30	34.99	3.31	5.07	.653	16,700	.894	14,900			16,170
12	38.26	35.02	3.24	5.05	.642	16,500	.891	14,700			16,210
13	38.29	35.03	3.26	5.07	.643	16,600	.891	14,800			16,040
14	38.34	35.00	3.34	5.09	.656	16,900	.895	15,100			16,170
15	38.44	35.02	3.42	5.14	.665	17,300	.898	15,500			16,630
16	38.57	35.03	3.54	5.20	.681	17,900	.904	16,200			17,190
17	38.70	35.05	3.65	5.26	.694	18,500	.909	16,800			17,770
18	38.94	35.05	3.89	5.38	.723	19,600	.919	18,000			19,030
19	39.15	35.02	4.13	5.48	.754	20,600	.930	19,200			20,330
20	39.32	35.01	4.31	5.57	.774	21,500	.936	20,100			21,430
21	39.44	35.03	4.41	5.63	.783	22,100	.939	20,800			22,180
22	39.61	35.03	4.58	5.70	.804	23,000	.945	21,700			23,310
23	39.79	35.03	4.76	5.80	.821	23,800	.950	22,600			24,270
24	39.96	35.00	4.96	5.88	.844	24,700	.957	23,600			24,190
25	40.05	35.02	5.03	5.92	.850	25,200	.959	24,200			25,290
26	40.15	35.04	5.11	5.98	.854	25,600	.960	24,600			25,750
27	40.21	35.01	5.20	6.00	.867	26,000	.964	25,100			26,040
28	40.25	35.00	5.25	6.02	.872	26,200	.966	25,300			26,240
29	40.25	35.02	5.23	6.02	.869	26,200	.965	25,300			26,470
30	40.24	35.02	5.22	6.02	.867	26,100	.964	25,200			26,300
						Total		556,200			540,100
						Mean		18,540			18,670

* From rating dated Aug. 30, 1951

** Computed by W.K.P.E.L. Co.

For composite record + Inflow between Grohman Narrows and Corra Linn Dam.

U. S. GOVERNMENT PRINTING OFFICE 16—54711-3

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ____ District ____

KOOTENAY RIVER AT GROHMAN, B.C. – Daily Mean Discharge, May 1950

Day	Gage Height Nelson No.10	Gage Height Corra Linn No.17	Fall F	Free Fall F_f	Fall Ratio F/F_f	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m		Discharge at Corra Linn Q_c**
1	40.22	35.01	5.21	6.01	0.867	26,000	0.964	25,100			26,270
2	40.22	35.01	5.21	6.01	.867	26,000	.964	25,100			26,130
3	40.22	35.03	5.19	6.01	.864	26,000	.963	25,000			26,350
4	40.20	34.96	5.24	6.00	.873	25,900	.966	25,000			26,160
5	40.18	35.00	5.18	5.99	.865	25,800	.964	24,900			25,910
6	40.26	35.03	5.23	6.03	.867	26,200	.964	25,300			26,430
7	40.26	35.00	5.26	6.03	.872	26,200	.966	25,300			26,530
8	40.28	35.00	5.28	6.04	.874	26,300	.966	25,400			26,590
9	40.36	35.05	5.31	6.08	.873	26,700	.966	25,800			26,970
10	40.44	35.01	5.43	6.12	.887	27,100	.970	26,300			28,570
11	40.61	35.05	5.56	6.19	.898	28,000	.973	27,200			29,510
12	40.90	35.06	5.84	6.34	.921	29,400	.980	28,800			30,390
13	41.38	35.04	6.34	6.58	.963	32,100	.993	31,900			33,330
14	42.04	35.06	6.98	6.90	1.000	35,600	1.000	35,600			36,770
15	42.83	34.93	7.90	7.28	1.+	40,100	1.000	40,100			41,470
16	43.69	35.06	8.63	7.71	1.+	45,100	1.000	45,100			47,560
17	44.43	34.97	9.46	8.07	1.+	49,700	1.000	49,700			52,630
18	45.07	35.04	10.03	8.39	1.+	53,800	1.000	53,800	54,700		57,280
19	45.61	35.03	10.58	8.64	1.+	57,400	1.000	57,400			61,120
20	45.96	35.00	10.96	8.82	1.+	59,700	1.000	59,700			63,290
21	46.13	35.01	11.12	8.90	1.+	60,900	1.000	60,900			65,670
22	46.20	35.02	11.18	8.94	1.+	61,400	1.000	61,400			66,330
23	46.37	35.01	11.36	9.03	1.+	62,600	1.000	62,600			67,490
24	46.54	35.02	11.52	9.10	1.+	63,800	1.000	63,800			68,710
25	46.71	35.02	11.69	9.18	1.+	65,000	1.000	65,000			69,970
26	46.86	35.02	11.84	9.28	1.+	66,000	1.000	66,000			70,950
27	47.03	35.01	12.02	9.34	1.+	67,200	1.000	67,200			72,310
28	47.25	35.03	12.22	9.46	1.+	69,000	1.000	69,000			73,870
29	47.46	35.03	12.43	9.56	1.+	70,700	1.000	70,700			76,880
30	47.66	35.03	12.63	9.65	1.+	72,300	1.000	72,300			78,660
31	47.87	35.03	12.84	9.76	1.+	74,000	1.000	74,000			[illegible]
						[illegible]		[illegible]			[illegible]

* From rating [illegible] Apr 30, 1951   Mean   45,600   80,690

** [illegible] by W.K.P.&L. Co.

*** For composite record.

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. { Washington .....
District .....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, June 1950

Day	Gage Height Nelson No 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f^*	Discharge Ratio J_f	Discharge $Q_{adj.}$	Measured Discharge Q_m	Inflow + (Est.)	Discharge at Corra Linn Q_p **	
1	48.02	35.00	13.02	9.83	1.+	75,200	1.000	75,200			80,480	
2	48.13	35.03	13.10	9.88	1.+	76,000	1.000	76,000			81,110	
3	48.18	34.98	13.20	9.91	1.+	76,400	1.000	76,400			81,470	
4	48.26	35.02	13.24	9.95	1.+	77,100	1.000	77,100			82,270	
5	48.34	35.02	13.37	10.02	1.+	78,100	1.000	78,100			83,260	
6	48.61	35.02	13.59	10.11	1.+	80,000	1.000	80,000			85,120	
7	48.84	35.02	13.82	10.23	1.+	82,100	1.000	82,100			87,880	
8	48.95	35.01	13.94	10.28	1.+	83,000	1.000	83,000			88,640	
9	49.07	35.03	14.04	10.35	1.+	84,100	1.000	84,100			89,690	
10	49.09	34.99	14.10	10.36	1.+	84,300	1.000	84,300			89,630	
11	49.09	35.01	14.08	10.36	1.+	84,300	1.000	84,300			89,620	
12	49.21	35.02	14.19	10.41	1.+	85,400	1.000	85,400			90,780	
13	49.45	35.03	14.42	10.57	1.+	87,600	1.000	87,600	87,800	1,200	92,730	
14	49.86	35.04	14.82	10.73	1.+	91,200	1.000	91,200			97,090	
15	50.35	35.05	15.30	10.98	1.+	95,600	1.000	95,600			101,240	
16	50.90	35.04	15.86	11.24	1.+	101,000	1.000	101,000			105,790	
17	51.47	35.06	16.41	11.53	1.+	106,700	1.000	106,700			111,390	
18	52.07	35.05	17.02	11.82	1.+	112,700	1.000	112,700			116,570	
19	52.61	35.04	17.57	12.07	1.+	118,100	1.000	118,100			122,400	
20	53.13	35.04	18.09	12.33	1.+	123,400	1.000	123,400			127,810	
21	53.65	35.04	18.61	12.58	1.+	129,200	1.000	129,200			132,540	
22	54.11	35.03	19.08	12.81	1.+	134,200	1.000	134,200			137,050	
23	54.42	35.04	19.38	12.97	1.+	137,600	1.000	137,600			140,380	
24	54.56	35.03	19.53	13.03	1.+	139,200	1.000	139,200			141,960	
25	54.58	35.02	19.56	13.04	1.+	139,400	1.000	139,400			142,150	
26	54.53	35.01	19.52	13.01	1.+	138,300	1.000	138,300			141,810	
27	54.37	34.99	19.38	12.95	1.+	137,100	1.000	137,100			140,120	
28	54.17	35.00	19.17	12.85	1.+	134,900	1.000	134,900	134,000		138,250	
29	53.96	35.01	18.95	12.74	1.+	132,600	1.000	132,600			135,370	
30	53.79	35.02	18.77	12.66	1.+	130,700	1.000	130,700			133,900	
						Total		3,155,500			3,288,500	
						Mean		105,200			109,600	

* From survey dated Aug 20, 1951

** Computed by W.K.P.F.L.Co.

*** For composite record

+ Inflow between Grohman Narrows and Corra Linn Dam.

U. S. GOVERNMENT PRINTING OFFICE 16—57927-3

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. { Washington ....
{ District ....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, July 1950

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio F/F_f	Free-fall Discharge Q_f *	Discharge Ratio J_F	Discharge Q_{adj}			Discharge at Corra Linn Q_p **	
1	53.68	35.03	18.65	12.60	1.+	129,500	1.000	129,500			132,710	
2	53.58	35.02	18.56	12.55	1.+	128,400	1.000	128,400			131,690	
3	53.49	35.02	18.47	12.52	1.+	127,400	1.000	127,400			131,070	
4	53.39	35.01	18.38	12.47	1.+	126,300	1.000	126,300			130,050	
5	53.25	35.02	18.23	12.40	1.+	124,800	1.000	124,800			129,050	
6	53.11	35.02	18.09	12.32	1.+	123,200	1.000	123,200			127,960	
7	52.93	35.01	17.92	12.23	1.+	121,300	1.000	121,300			125,210	
8	52.84	36.36	16.48	12.19	1.+	120,400	1.000	120,400			124,650	
9	52.55	38.00	14.55	12.04	1.+	117,500	1.000	117,500			120,290	
10	52.31	37.99	14.32	11.93	1.+	115,100	1.000	115,100			118,000	
11	52.03	37.97	14.06	11.79	1.+	112,300	1.000	112,300			114,730	
12	51.73	39.14	12.59	11.64	1.+	109,300	1.000	109,300			109,170	
13	51.40	39.97	11.43	11.49	.995	106,000	.999	105,900			105,480	
14	50.99	40.00	10.99	11.29	.973	101,900	.996	101,500			102,060	
15	50.60	40.01	10.59	11.09	.955	98,000	.990	97,000			98,070	
16	50.22	39.97	10.25	10.91	.940	94,500	.986	93,200			94,040	
17	49.81	39.97	9.84	10.70	.920	90,800	.980	89,000			89,410	
18	49.43	40.00	9.43	10.52	.896	87,400	.973	85,000			85,670	
19	49.06	40.00	9.06	10.34	.876	84,000	.967	81,200			82,470	
20	48.73	40.01	8.72	10.17	.857	81,100	.961	77,900			79,650	
21	48.34	39.98	8.41	10.02	.839	78,100	.956	74,700			76,860	
22	48.08	40.00	8.08	9.86	.820	75,600	.950	71,800			74,230	
23	47.76	39.95	7.81	9.70	.805	73,100	.946	69,200			70,820	
24	47.43	40.00	7.43	9.54	.779	70,400	.938	66,000			67,840	
25	47.15	40.01	7.14	9.40	.760	68,200	.932	63,600			65,510	
26	46.90	39.99	6.91	9.28	.745	66,300	.926	61,400			63,570	
27	46.64	39.76	6.88	9.15	.752	64,500	.929	59,900			62,250	
28	46.35	38.80	7.55	9.02	.837	62,400	.955	59,600			61,450	
29	46.06	38.26	7.80	8.87	.879	60,400	.968	58,400			60,380	
30	45.83	38.02	7.81	8.75	.893	58,900	.972	57,300			59,170	
31	45.58	38.01	7.57	8.63	[illegible]	[illegible]	[illegible]	[illegible]			57,320	
						Total		[illegible]			[illegible]	
						Mean		93,010			95,120	

* From [illegible] Apr. 20, 1951
** Computed by W.K.P. & L. Co.
[illegible] For composite record.

9-250

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ..... District .....

KOOTENAY RIVER AT GROHMAN, B.C — Daily Mean Discharge, August 1950

Day	Gage Height: Nelson No. 10	Gage Height: Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{msi}	Measured Discharge Q_m	Inflow + (Est.)	Discharge at Corra Linn Q_p **	
1	45.30	37.99	7.31	8.50	0.860	55,300	0.962	53,200	54,800	35	55,610	
2	45.02	38.00	7.02	8.36	.840	53,400	.956	51,100			53,320	
3	44.76	38.01	6.75	8.23	.820	51,800	.950	49,200			50,610	
4	44.50	38.01	6.49	8.10	.801	50,100	.944	47,300			44,010	
5	44.25	37.99	6.26	7.98	.784	48,600	.934	45,600			47,330	
6	44.00	38.03	5.97	7.86	.760	47,000	.932	43,800			45,420	
7	43.79	38.00	5.79	7.76	.746	45,700	.927	42,400			44,070	
8	43.67	39.11	4.56	7.70	.592	45,000	.871	39,200			39,450	
9	43.76	41.03	2.73	7.74	.353	45,600	.750	34,200			31,470	
10	44.65	44.46	.19	8.18	.023	51,100	.145	7,410			8,970	
11	44.97	44.78	.19	8.34	.023	53,100	.145	7,700			9,100	
12	45.22	45.06	.16	8.46	.019	54,800	.124	6,800			9,250	
13	45.48	45.32	.16	8.59	.019	56,600	.127	7,020			8,980	
14	45.72	45.54	.18	8.70	.021	58,100	.135	7,840			9,320	
15	46.01	45.84	.17	8.84	.019	60,100	.124	7,450			9,000	
16	46.34	46.22	.17	9.04	.019	62,700	.124	7,770			9,070	
17	46.60	46.25	.35	9.13	.038	64,200	.212	13,600			15,590	
18	46.56	45.84	.72	9.11	.079	63,900	.357	22,800			22,820	
19	46.50	45.66	.84	9.08	.093	63,500	.398	25,300			26,140	
20	46.49	45.63	.86	9.08	.095	63,400	.404	25,600			25,960	
21	46.50	45.77	.73	9.08	.080	63,500	.360	22,400			23,680	
22	46.62	46.15	.47	9.14	.051	64,300	.264	17,000			18,880	
23	46.64	45.99	.65	9.15	.071	64,500	.333	21,500			22,450	
24	46.57	45.71	.86	9.12	.094	64,000	.401	25,700			24,060	
25	46.57	45.78	.79	9.12	.087	64,000	.381	24,400			24,980	
26	46.59	45.86	.73	9.13	.080	64,100	.360	23,100			23,920	
27	46.61	45.90	.71	9.13	.078	64,300	.354	22,800			23,120	
28	46.62	46.01	.61	9.14	.067	64,300	.320	20,600			21,610	
29	46.67	46.11	.56	9.17	.061	64,700	.298	19,300			20,410	
30	46.67	46.11	.56	9.17	.061	64,700	.298	19,300			20,500	
31	46.66	46.11		9.16	.061	64,600	.298	19,200			20,170	
						Total		781,040			814,770	744,780
						Mean		25,200			26,350	25,640

* From rating dated Aug 20, 1951

** Computed by W.K.P.P.L. Co.

o For composite record + Inflow between Grohman Narrows and Corra Linn Dam

U. S. GOVERNMENT PRINTING OFFICE 16—43751-1

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. -- Daily Mean Discharge, September 1950

Day	Gage Height: Nelson No. 10	Gage Height: Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f *	Discharge Ratio J_f	Discharge Q_{adj}			Discharge at Corra Linn Q_p **	
1	46.66	46.11	0.55	9.16	0.060	64,600	0.245	14,100			20,040	
2	46.66	46.17	.49	9.16	.053	64,600	.270	17,400			19,230	
3	46.67	46.21	.46	9.17	.050	64,700	.260	16,800			18,570	
4	46.65	46.20	.45	9.16	.049	64,600	.256	16,500			17,560	
5	46.64	46.27	.42	9.18	.046	64,800	.244	15,800			17,130	
6	46.71	46.36	.35	9.18	.038	65,000	.212	13,800			15,110	
7	46.79	46.48	.31	9.23	.034	65,500	.196	12,800			14,750	
8	46.82	46.55	.27	9.24	.029	65,700	.175	11,500			13,430	
9	46.90	46.66	.24	9.28	.026	66,300	.160	10,600			12,010	
10	46.97	46.72	.25	9.32	.027	66,800	.165	11,000			12,960	
11	46.97	46.75	.22	9.32	.024	66,800	.150	10,000			11,930	
12	47.02	46.84	.18	9.34	.019	67,200	.124	8,330			10,140	
13	47.09	46.90	.19	9.38	.020	67,700	.130	8,800			10,530	
14	47.07	46.81	.26	9.37	.028	67,600	.170	11,500			13,090	
15	47.05	46.81	.24	9.36	.026	67,400	.160	10,800			12,430	
16	47.08	46.88	.20	9.37	.021	67,600	.135	9,120			10,820	
17	47.10	46.91	.19	9.38	.020	67,800	.130	8,810			10,650	
18	47.10	46.92	.18	9.38	.019	67,800	.124	8,410			10,410	
19	47.12	46.95	.17	9.39	.018	68,000	.118	8,020			10,220	
20	47.11	46.89	.22	9.38	.023	67,900	.145	9,850			12,000	
21	47.08	46.85	.23	9.37	.025	67,600	.155	10,500			12,510	
22	47.07	46.87	.20	9.37	.021	67,600	.135	9,120			11,250	
23	47.08	46.89	.19	9.37	.020	67,600	.130	8,790			10,800	
24	47.09	46.90	.19	9.38	.020	67,700	.130	8,800			10,440	
25	47.10	46.90	.20	9.38	.021	67,800	.135	9,150			10,750	
26	47.10	46.85	.25	9.38	.027	67,800	.165	11,200			12,230	
27	47.05	46.80	.25	9.35	.027	67,400	.165	11,100			12,930	
28	47.07	46.85	.22	9.37	.023	67,600	.145	9,800			11,340	
29	47.10	46.89	.21	9.38	.022	67,800	.140	9,490			11,680	
30	47.09	46.87	.22	9.38	.023	67,700	.145	9,820			11,240	
						Total		336,710			387,730	388,752
						Mean		11,220			12,920	12,690

* From rating table Rev. 20, 1951

** Computed by W.K. Pfl. G.

*** For composite record.

U. S. GOVERNMENT PRINTING OFFICE 16—62721-1

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. | Water Division
District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, March 1951

Day	Gage Height Nelson No.10	Gage Height Corra Linn No.17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f *	Discharge Ratio J_F	Discharge $Q_{adj.}$			Discharge at Corra Linn Q_p **	
1	41.84	40.40	1.44	6.80	0.212	34,500	0.619	21,400			20,710	
2	41.70	40.30	1.40	6.73	.208	33,800	.613	20,700			20,140	
3	41.57	40.31	1.26	6.67	.189	33,000	.586	19,300			18,990	
4	41.62	40.33	1.29	6.69	.193	33,300	.592	19,700			19,870	
5	41.51	40.30	1.21	6.64	.182	32,800	.576	18,900			19,180	
6	41.34	40.29	1.05	6.56	.160	31,800	.542	17,200			17,850	
7	41.21	40.31	.90	6.49	.139	31,200	.504	15,700			16,260	
8	41.15	40.19	.96	6.46	.149	30,800	.523	16,100			16,260	
9	40.98	40.28	.70	6.38	.110	29,900	.442	13,200			13,080	
10	40.91	40.21	.70	6.34	.110	29,500	.442	13,000			13,600	
11	40.86	40.07	.79	6.32	.125	29,200	.476	13,900			14,200	
12	40.77	39.92	.85	6.27	.136	28,800	.498	14,300			14,460	
13	40.68	39.68	1.00	6.23	.160	28,300	.542	15,300			14,970	
14	40.56	39.46	1.10	6.17	.178	27,700	.570	15,800			15,630	
15	40.38	39.02	1.36	6.09	.223	26,800	.633	17,000			16,910	
16	40.15	38.46	1.69	5.97	.283	25,600	.695	17,800			17,820	
17	40.02	37.86	2.16	5.91	.365	25,000	.758	19,000			19,400	
18	39.83	37.24	2.59	5.81	.445	24,000	.806	19,300			20,190	
19	39.64	36.98	2.66	5.72	.465	23,100	.816	18,900			19,590	
20	39.51	37.01	2.50	5.66	.442	22,400	.804	18,000			18,790	
21	39.36	37.00	2.36	5.59	.422	21,700	.793	17,200			18,000	
22	39.27	36.96	2.31	5.54	.417	21,200	.790	16,700			17,560	
23	39.16	36.98	2.18	5.49	.397	20,700	.778	16,100			16,850	
24	39.10	37.12	1.98	5.46	.363	20,400	.757	15,400			16,230	
25	39.04	37.31	1.73	5.43	.319	20,100	.725	14,600			15,280	
26	38.98	37.34	1.64	5.40	.304	19,800	.713	14,100			14,940	
27	38.95	37.47	1.48	5.38	.275	19,600	.688	13,500			14,120	
28	38.95	37.42	1.53	5.38	.284	19,600	.696	13,600			14,450	
29	38.92	37.41	1.51	5.37	.281	19,500	.693	13,500			14,220	
30	38.90	37.55	1.35	5.36	.252	19,400	.665	12,900			13,460	
31	38.91	37.63	1.28	5.36	.239	19,400	.651	12,600			13,310	
						Total		504,700			516,320	
						Mean		16,280			16,660	

* From rating dated Aug. 20, 1951.
** Computed by W.K.P. & L. Co.

U. S. GOVERNMENT PRINTING OFFICE 16—43701-1

9-330

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ..... District .....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, April 1951

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f *	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m	Inflow + (Est.)	Discharge at Corra Linn Q_p **
1	38.92	37.62	1.30	5.37	0.242	19,500	0.654	12,800			13,440
2	38.42	37.35	1.57	5.37	.292	19,500	.703	13,700			14,690
3	39.03	37.87	1.16	5.42	.214	20,000	.621	12,400			12,520
4	38.97	37.01	1.96	5.40	.363	19,800	.757	15,000			15,980
5	39.02	37.01	2.01	5.42	.371	20,000	.763	15,300			16,190
6	39.16	36.84	2.32	5.49	.422	20,100	.793	16,400			17,780
7	39.21	35.70	3.51	5.51	.637	21,000	.884	18,700			20,340
8	39.30	35.01	4.29	5.56	.772	21,400	.936	20,000			20,790
9	39.43	35.01	4.42	5.62	.787	22,000	.940	20,700			20,970
10	39.51	35.00	4.51	5.69	.803	22,800	.945	21,600	21,400	290	21,740
11	39.71	35.02	4.69	5.75	.816	23,400	.949	22,200			22,350
12	39.81	35.00	4.81	5.80	.829	24,000	.953	22,900			22,990
13	39.87	35.03	4.84	5.84	.829	24,200	.953	23,100			23,310
14	40.05	35.01	5.04	5.92	.852	25,200	.960	24,200			24,330
15	40.25	35.01	5.24	6.02	.870	26,200	.965	25,300			25,440
16	40.46	35.01	5.45	6.13	.889	27,200	.971	26,400			26,260
17	40.67	35.02	5.65	6.23	.907	28,200	.976	27,500			28,250
18	40.84	34.99	5.85	6.31	.927	29,100	.982	28,600			27,870
19	41.10	35.01	6.09	6.44	.946	30,600	.988	30,200			30,740
20	41.22	35.02	6.20	6.50	.954	31,200	.990	30,900			31,170
21	41.30	35.02	6.28	6.54	.960	31,600	.992	31,400			31,530
22	41.35	35.01	6.34	6.56	.967	31,900	.994	31,700			31,560
23	41.37	35.03	6.34	6.58	.962	32,000	.993	31,800			31,860
24	41.35	34.98	6.37	6.56	.971	31,900	.995	31,700			31,640
25	41.32	35.00	6.32	6.55	.965	31,700	.994	31,500			31,540
26	41.29	35.00	6.29	6.54	.962	31,600	.993	31,400			31,490
27	41.27	34.99	6.28	6.53	.962	31,400	.993	31,200			31,510
28	41.33	35.00	6.33	6.55	.966	31,800	.994	31,600			31,850
29	41.41	35.01	6.40	6.59	.971	32,200	.995	32,000			32,190
30	41.59	35.01	6.58	6.68	.985	33,200	.998	33,100			33,160
						Total		775,300			755,530
						Mean		24,610			25,180

* From rating dated July 20, 1951.
** Computed by W K P E L Co.
+ Inflow between Grohman Narrows and Corra Linn Dam

U. S. GOVERNMENT PRINTING OFFICE 16—48721-1

9-330

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington ..... District .....

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, May 1951

Day	Gage Height Nelson No 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f *	Discharge Ratio J_F	Discharge Q_{Adj}	Measured Discharge Q_m	Inflow (Est.)	Discharge at Corra Linn Q_p **
1	41.87	35.01	6.86	6.82	1.006	34,600	1.000	34,600			34,860
2	42.14	34.98	7.16	6.95	1.+	36,100	1.000	36,100			36,610
3	42.40	35.01	7.39	7.08	1.+	37,600	1.000	37,600			38,910
4	42.64	35.00	7.64	7.19	1.+	39,000	1.000	39,000	40,300		40,620
5	42.87	35.30	7.57	7.31	1.+	40,300	1.000	40,300			41,830
6	43.21	35.57	7.64	7.47	1.+	42,300	1.000	42,300			44,070
7	43.68	35.84	7.84	7.70	1.+	45,100	1.000	45,100			47,180
8	44.31	36.29	8.02	8.01	1.+	49,000	1.000	49,000	48,800		50,910
9	45.07	36.71	8.36	8.34	.997	53,800	1.000	53,800			56,200
10	45.89	37.20	8.69	8.79	.989	59,200	.999	59,100	58,010	2,130	61,070
11	46.70	37.68	9.02	9.18	.983	64,900	.998	64,800	63,820	2,560	67,600
12	47.64	38.15	9.49	9.64	.984	72,100	.998	72,000			74,130
13	48.47	38.61	9.86	10.05	.981	78,800	.997	78,600	76,380	2,130	80,030
14	49.20	39.09	10.11	10.41	.971	85,300	.995	84,800			86,840
15	49.75	39.26	10.49	10.68	.982	90,200	.998	90,000	87,820	1,700	91,180
16	50.17	39.42	10.75	10.89	.987	94,000	.998	93,800			94,680
17	50.50	39.61	10.89	11.04	.986	97,000	.998	96,800	97,500		97,130
18	50.76	39.89	10.87	11.17	.974	99,600	.996	99,200			98,890
19	51.00	39.96	11.04	11.29	.978	102,000	.997	101,700			100,980
20	51.19	40.11	11.08	11.39	.973	103,900	.996	103,500			103,780
21	51.37	40.22	11.15	11.48	.971	105,700	.995	105,200	104,400		105,330
22	51.52	40.32	11.20	11.55	.970	107,200	.995	106,700			106,610
23	51.71	40.44	11.27	11.63	.969	109,100	.995	108,600			108,090
24	51.95	40.57	11.38	11.76	.968	111,500	994	110,800			109,870
25	52.16	40.70	11.46	11.86	.966	113,600	.994	113,000	106,600	1,520	111,600
26	52.30	40.72	11.58	11.93	.970	115,000	.995	114,400			112,700
27	52.40	40.79	11.61	11.98	.969	116,000	.995	115,400			113,560
28	52.33	40.79	11.54	11.94	.966	115,300	.994	114,600	108,900	1,360	112,810
29	52.22	40.78	11.44	11.89	.962	114,200	.993	113,400			112,070
30	51.99	41.24	10.75	11.78	.912	111,900	.978	109,500			108,210
31	51.78	42.90	8.88	11.67	.761	109,800	.932	102,400			102,670
						Total		2,534,100			2,551,020
						Mean		81,810			82,290

* From rating dated Aug. 20, 1951

** Computed by W.K.P.F.C. Co.

† Inflow between Grohman Narrows and Corra Linn Dam

9-330

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. 7.11
Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, JUNE 1951

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_r	Discharge Q_{day}	Measured Discharge Q_m	Inflow+ (Est.)	Discharge at Corra Linn Q_p**	
1	51.45	42.94	8.46	11.51	0.735	106,500	0.923	98,200			97,210	
2	51.07	43.00	8.07	11.33	.712	102,700	.915	94,000			94,030	
3	50.71	43.00	7.71	11.14	.692	99,100	.908	90,000			91,250	
4	50.25	40.18	10.07	10.92	.922	94,800	.981	93,000			95,930	
5	49.57	35.51	14.06	10.59	1.+	88,600	1.000	88,600	90,800		94,640	
6	49.14	35.19	13.95	10.38	1.+	84,800	1.000	84,800	87,700		91,300	
7	48.77	34.51	14.26	10.19	1.+	81,400	1.000	81,400	84,200		88,090	
8	48.43	35.09	13.34	10.03	1.+	78,400	1.000	78,400	78,540	200	83,820	
9	48.22	38.12	10.10	9.93	1.+	76,800	1.000	76,800			77,950	
10	48.28	41.94	6.34	9.96	.637	77,200	.889	68,600			68,470	
11	48.58	44.02	4.56	10.10	.451	79,700	.808	64,400	64,450	200	64,750	
12	48.72	43.99	4.73	10.17	.465	81,000	.816	66,100			66,110	
13	48.95	43.97	4.98	10.29	.484	83,000	.825	68,500			68,050	
14	49.20	43.16	6.04	10.41	.580	85,300	.866	73,900			75,920	
15	49.45	41.47	7.98	10.53	.758	87,600	.931	81,600			83,750	
16	49.81	39.59	10.22	10.70	.955	90,800	.990	89,900			91,200	
17	50.14	39.01	11.13	10.87	1.+	93,800	1.000	93,800			95,280	
18	50.43	39.00	11.43	11.01	1.+	96,400	1.000	96,400			98,110	
19	50.78	38.99	11.79	11.18	1.+	99,800	1.000	99,800			101,610	
20	50.95	38.99	11.96	11.27	1.+	101,500	1.000	101,500	98,670	373	103,000	
21	50.98	38.98	12.00	11.28	1.+	101,800	1.000	101,800			103,140	
22	50.89	38.99	11.90	11.24	1.+	100,900	1.000	100,900	97,980	323	100,580	
23	50.72	38.99	11.73	11.15	1.+	99,200	1.000	99,200			101,000	
24	50.58	38.98	11.60	11.09	1.+	97,800	1.000	97,800			99,890	
25	50.59	41.38	9.21	11.09	.831	97,400	.953	93,300			91,670	
26	50.83	43.99	6.84	11.20	.611	100,300	.878	88,100			88,460	
27	50.83	44.00	6.83	11.20	.610	100,300	.878	88,100			89,100	
28	50.77	43.98	6.79	11.18	.607	99,700	.877	87,400			88,610	
29	50.68	43.99	6.69	11.13	.601	98,800	.874	86,300			86,200	
30	50.60	43.97	6.63	11.09	.598	98,000	.873	85,600			85,420	
						Total		2,618,200			2,666,580	
						Mean		87,270			88,890	

* From rating dated Aug. 20, 1951.
for Computed by W.K.P.E.L. Co.
+ Inflows between Grohman Narrows and Corra Linn Dam.

U. S. GOVERNMENT PRINTING OFFICE 16—84721-1

9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. 7-11
Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. — Daily Mean Discharge, July 1951

Day	Gage Height Nelson No. 10	Gage Height Corra Linn No. 17	Fall F	Free Fall F_f	Fall Ratio $\frac{F}{F_f}$	Free-fall Discharge Q_f*	Discharge Ratio J_F	Discharge Q_{adj}	Measured Discharge Q_m	Inflow† (Est.)	Discharge at Corra Linn Q_p**
1	50.50	43.99	6.51	11.04	0.590	97,000	0.870	84,400			84,680
2	50.41	43.99	6.42	11.00	.584	96,200	.868	83,500			83,620
3	50.31	43.58	6.73	10.95	.614	95,300	.880	83,900			84,540
4	50.23	43.04	7.19	10.91	.659	94,600	.897	84,800			86,700
5	50.25	43.02	7.23	10.92	.662	94,800	.898	85,100			86,970
6	50.35	43.03	7.32	10.97	.667	95,600	.899	86,000			87,720
7	50.47	43.02	7.45	11.03	.675	96,700	.902	87,200			88,750
8	50.53	43.01	7.52	11.05	.680	97,300	.904	88,000			89,330
9	50.56	43.02	7.54	11.07	.681	97,600	.904	88,200			89,600
10	50.52	43.00	7.52	11.05	.681	97,200	.904	87,800			89,400
11	50.42	43.01	7.41	11.01	.673	96,300	.901	86,800			88,360
12	50.30	43.01	7.29	10.95	.666	95,200	.899	85,600	84,020	160	87,460
13	50.19	43.00	7.19	10.90	.660	94,200	.897	84,500			86,480
14	50.08	43.01	7.07	10.84	.652	93,200	.894	83,300			85,230
15	50.00	42.99	7.01	10.80	.649	92,500	.893	82,600			84,690
16	49.96	42.99	6.97	10.78	.647	92,100	.892	82,200			84,330
17	49.95	42.99	6.96	10.78	.646	92,000	.892	82,100			84,170
18	49.76	40.53	9.23	10.68	.864	90,300	.963	87,000			90,430
19	49.43	38.20	11.23	10.82	1.+	87,400	1.000	87,400			90,840
20	49.27	37.99	11.28	10.45	1.+	85,900	1.000	85,900			89,680
21	49.07	37.72	11.35	10.35	1.+	84,100	1.000	84,100			88,300
22	48.82	37.37	11.45	10.22	1.+	81,900	1.000	81,900			86,410
23	48.52	37.03	11.49	10.07	1.+	79,200	1.000	79,200			83,890
24	48.20	36.99	11.21	9.92	1.+	76,600	1.000	76,600			80,650
25	47.88	37.00	10.88	9.76	1.+	74,000	1.000	74,000			77,990
26	47.58	37.02	10.56	9.61	1.+	71,600	1.000	71,600			75,810
27	47.27	37.02	10.25	9.47	1.+	69,200	1.000	69,200			72,650
28	47.01	37.01	10.00	9.33	1.+	67,100	1.000	67,100			70,130
29	46.75	37.02	9.73	9.20	1.+	65,200	1.000	65,200			68,340
30	46.46	37.03	9.43	9.06	1.+	63,200	1.000	63,200			66,140
31	46.19	37.00	9.19	8.94	1.+	61,300	1.000	61,300			64,230
						Total		2,449,800			2,577,590
						Mean		79,030			83,150

* From rating dated Aug. 20, 1951

** Computed by W.K.P. & L. Co.

† Inflow between Grohman Narrows and Corra Linn Dam

U. S. GOVERNMENT PRINTING OFFICE 16—54775-1

9-330

TABLE 12

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. Washington
District

KOOTENAY RIVER AT GROHMAN, B.C. — Summary of Monthly Discharge

Month	No. of Days	No of Days fall >0.4 ft	At Grohman				Discharge at Corra Linn *	Deviation from Grohman Data		Composite Record **	Deviation from Corra Linn Data	
			Mean Discharge	Mean Inflow (est.)	Total							
1947										↑		
Mar	31	31	17,080	50	17,130		17,680	+3.2				
Apr	30	30	25,220	300	25,520		26,590	+4.2				
May	31	31	74,850	600	80,450		85,080	+5.8		Grohman Data		
June	30	30	85,920	800	86,720		91,010	+4.9				
July	31	31	54,890	200	55,090		56,190	+2.0				
Aug	31	31	20,830	60	20,890		20,460	−2.0		↓		
1948												
Oct	31	0	8,710	50	8,760		9,820	+12.1		9,820	—	
Nov	30	2	8,840	60	8,900		10,250	+15.2		10,250	—	
Dec	31	3	9,930	80	10,010		11,650	+16.4		11,570	−0.7	
1949 Jan	31	0	9,070	40	9,110		10,070	+10.5		10,070	—	
Feb	28	12	11,000	30	11,030		11,990	+8.7		11,720	−2.3	
Mar	31	31	18,120	50	18,170		18,760	+3.2		18,170	−3.1	
Apr	30	30	18,540	200	18,740		19,670	+5.0		18,740	−4.7	
May	31	31	45,660	800	46,460		48,690	+4.8		46,460	−4.6	
June	30	30	105,200	1,000	106,200		109,600	+3.2		106,200	−3.1	
July	31	31	93,010	250	93,260		95,120	+2.0		93,260	−2.0	
Aug	31	23	25,200	40	25,240		26,350	+4.4		25,670	−2.6	
Sept	30	5	11,200	30	11,250		12,920	+14.8		12,700	−1.7	
1951												
Mar	31	31	16,280	50	16,330		16,660	+2.0		↑		
Apr	30	30	24,840	400	25,240		25,180	−0.2		Grohman Data		
May	31	31	81,810	1,500	83,310		82,290	−1.2				
June	30	30	87,270	300	87,570		88,890	+1.5				
July	31	31	80,640	150	80,790		83,150	+2.9		↓		

* Computed by W.K.P.E.L. Co.

** Combination of Grohman data (when fall < 0.4 ft.) and Corra Linn data (when fall > 0.4 ft.); inflow added to portion obtained from Grohman record.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. | Washington | District

TABLE 13 1 of 4

KOOTENAY LAKE STORAGE COMPUTATIONS APRIL 1950

Day	Actual Conditions: Elev. at Queens Bay Mean for day	Queens Bay Start of day	Change during day	Equiv. ① change in cfs	② Discharge at Grohman in cfs	Total supply in cfs	1929 Outlet Conditions: Elev. at Queens Bay Start of day	Change ① during day	Bay Mean for day	③ Discharge at Nelson in cfs	① Required Lowering	Actual Lowering	
1	39.11	39.145	-0.075	-4100	15700	11600	41.390	+0.010	41.40	10800	2.08	2.29	+.12
2	39.03	39.070	-.055	-3000	15600	12600	41.400	+.020	41.41	10800	1.01	2.38	1.27
3	39.00	39.015	-.020	-1100	15500	14400	41.420	+.050	41.44	10900	1.02	2.44	1.42
4	38.99	38.995	-.020	-1100	15400	14300	41.470	+.050	41.50	11100	1.02	2.51	1.49
5	38.96	38.975	-.020	-1100	15400	14300	41.520	+.040	41.54	11200	1.02	2.58	1.56
6	38.95	38.955	-.020	-1100	15100	14000	41.560	+.040	41.58	11400	1.03	2.63	1.60
7	38.92	38.935	-.025	-1400	15100	13700	41.600	+.030	41.62	11500	1.03	2.70	1.67
8	38.90	38.910	-.010	-600	14900	14300	41.630	+.030	41.64	11600	1.03	2.74	1.71
9	38.90	38.900	-.010	-600	14900	14300	41.660	+.030	41.68	11700	1.03	2.78	1.75
10	38.88	38.890	-.020	-1100	14900	13800	41.690	+.030	41.70	11800	1.03	2.82	1.79
11	38.86	38.870	-.015	-800	14900	14100	41.720	+.030	41.74	11900	1.04	2.88	1.84
12	38.85	38.855	+.010	+600	14700	15300	41.750	+.050	41.78	12100	1.04	2.93	1.89
13	38.88	38.865	+.050	+2800	14800	17600	41.800	+.080	41.84	12300	1.04	2.96	1.92
14	38.95	38.915	+.095	+5200	15100	20300	41.880	+.130	41.94	12600	1.05	2.99	1.94
15	39.07	39.010	+.145	+8000	15500	23500	42.010	+.170	42.10	13200	1.06	3.03	1.97
16	39.24	39.155	+.190	+10500	16200	26700	42.180	+.220	42.29	13900	1.07	3.05	1.98
17	39.45	39.345	+.220	+12100	16800	28900	42.400	+.230	42.52	14800	1.09	3.07	1.98
18	39.68	39.565	+.230	+12700	18000	30700	42.630	+.250	42.76	15700	1.11	3.08	1.97
19	39.91	39.795	+.220	+12200	19200	31400	42.880	+.250	43.00	16700	1.12	3.09	1.97
20	40.12	40.015	+.195	+10800	20100	30900	43.130	+.220	43.24	17700	1.14	3.12	1.98
21	40.30	40.210	+.190	+10500	20800	31300	43.350	+.210	43.46	18600	1.16	3.16	2.00
22	40.50	40.400	+.200	+11100	21700	32800	43.560	+.220	43.67	19500	1.17	3.17	2.00
23	40.70	40.600	+.190	+10500	22600	33100	43.780	+.210	43.88	20400	1.19	3.18	1.99
24	40.88	40.790	+.150	+8300	23600	31900	43.990	+.170	44.08	21300	1.21	3.20	1.99
25	41.00	40.940	+.110	+6100	24200	30300	44.160	+.140	44.23	22000	1.22	3.23	2.01
26	41.10	41.050	+.075	+4200	24600	28800	44.300	+.100	44.35	22500	1.23	3.25	2.02
27	41.15	41.125	+.040	+2200	25100	27300	44.400	+.070	44.44	22900	1.24	3.29	2.05
28	41.18	41.165	+.010	+600	25300	25900	44.470	+.040	44.49	23200	1.25	3.31	2.06
29	41.17	41.175	-.005	-300	25300	25000	44.510	+.020	44.52	23300	1.25	3.35	2.10
30	41.17	41.170	-.005	-300	25200	24900	44.530	+.020	44.54	23400	1.25	3.37	2.12

① Determined on basis of curves and tables in report "Development of the Discharge Curve and Storage Diagram for Original Outlet Conditions"

② Computed on basis of Grohman rating; actual outflow from Kootenay Lake and equivalent to discharge at Nelson.

* As computed at Corra Linn.

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. | Washington ... | District ...

KOOTENAY LAKE STORAGE COMPUTATIONS MAY 1950

Day	Actual Conditions: Elev. at Queens Bay Mean for day	Actual Conditions: Elev. at Queens Bay Start of day	Actual Conditions: Elev. at Queens Bay change during day	Actual Conditions: Equiv. change in cfs.	Actual Conditions: Discharge at Grohman in cfs	Total supply in cfs	1929 Outlet Conditions: Elev. at Queens Bay Start of day	1929 Outlet Conditions: Elev. at Queens Bay change during day	1929 Outlet Conditions: Elev. at Queens Bay Mean for day	1929 Outlet Conditions: Discharge at Nelson in cfs	Required Lowering	Actual Lowering	
1	41.16	41.165	-0.010	-600	25100	24500	44.550	+0.010	44.56	23500	1.25	3.40	2.15
2	41.15	41.155	-.005	-300	25100	24800	44.560	+.010	44.56	23500	1.25	3.41	2.16
3	41.15	41.150	+.010	+600	25000	25600	44.570	+.020	44.58	23600	1.25	3.43	2.18
4	41.17	41.160	+.030	+1700	25000	26700	44.590	+.050	44.62	23800	1.26	3.45	2.19
5	41.21	41.190	+.035	+1400	24900	26300	44.640	+.040	44.66	24000	1.26	3.45	2.19
6	41.24	41.225	+.025	+1400	25300	26700	44.680	+.040	44.70	24100	1.26	3.46	2.20
7	41.26	41.250	+.015	+800	25300	26100	44.720	+.020	44.73	24300	1.26	3.47	2.21
8	41.27	41.265	+.025	+1400	25400	26800	44.740	+.030	44.76	24400	1.26	3.49	2.23
9	41.31	41.290	+.070	+3900	25800	29700	44.770	+.080	44.81	24700	1.26	3.50	2.24
10	41.41	41.360	+.150	+8400	26300	34700	44.850	+.160	44.93	25200	1.27	3.52	2.25
11	41.61	41.510	+.275	+15300	27200	42500	45.010	+.270	45.14	26200	1.30	3.53	2.23
12	41.96	41.785	+.465	+26000	28800	54800	45.280	+.450	45.50	28000	1.32	3.54	2.22
13	42.54	42.250	+.695	+39100	31900	71000	45.730	+.670	46.06	30800	1.38	3.52	2.14
14	43.35	42.945	+.885	+50400	35600	86000	46.400	+.850	46.82	34700	1.45	3.47	2.02
15	44.31	43.830	+.975	+52400	40100	96500	47.250	+.940	47.72	39500	1.53	3.41	1.88
16	45.30	44.805	+.960	+51500	45100	101600	48.190	+.930	48.66	44700	1.62	3.36	1.74
17	46.23	45.765	+.860	+51200	44700	100400	49.120	+.830	49.54	44800	1.71	3.31	1.60
18	47.02	46.625	+.695	+41600	53800	95400	49.950	+.660	50.28	54200	1.80	3.26	1.46
19	47.62	47.320	+.485	+29100	57400	86500	50.610	+.470	50.84	57600	1.85	3.22	1.37
20	47.99	47.805	+.285	+17200	59700	76900	51.080	+.270	51.22	59100	1.89	3.23	1.34
21	48.19	48.090	+.170	+10200	60900	71100	51.350	+.150	51.42	61200	1.92	3.23	1.31
22	48.33	48.260	+.140	+8400	61400	69800	51.500	+.120	51.56	62000	1.93	3.23	1.30
23	48.47	48.400	+.175	+10600	62600	73200	51.620	+.160	51.70	62900	1.95	3.23	1.28
24	48.68	48.575	+.200	+12100	63800	75900	51.780	+.180	51.87	64000	1.97	3.14	1.22
25	48.87	48.775	+.170	+10300	65000	75300	51.960	+.160	52.04	65100	1.99	3.17	1.18
26	49.02	48.945	+.180	+10900	66000	76900	52.120	+.170	52.20	66100	2.00	3.18	1.18
27	49.23	49.125	+.240	+14500	67200	81700	52.290	+.220	52.40	67400	2.01	3.17	1.16
28	49.50	49.365	+.280	+17000	69000	86000	52.510	+.265	52.64	68900	2.04	3.14	1.10
29	49.79	49.645	+.335	+20400	70700	91100	52.775	+.320	52.94	70800	2.07	3.15	1.08
30	50.17	49.980	+.245	+15000	72300	87300	53.095	+.230	53.21	72600	2.10	3.04	.94
31	50.28	50.225	+.125	+7600	74000	81600	53.325	+.120	53.38	73700	2.12	3.10	.98

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9-230

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. T-13 3 of 4
Washington
District

KOOTENAY LAKE STORAGE COMPUTATIONS JUNE 1950

Day	Actual Conditions: Elev at Queens Bay Mean for day	Elev at Queens Bay Start of day	Change during day	Equiv change in cfs	Discharge at Grohman in cfs	Total supply in cfs	1929 Outlet Conditions: Elev at Queens Bay Start of day	Change during day	Mean for day	Discharge at Nelson in cfs	Required Lowering	Actual Lowering	
1	50.42	50.350	+0.105	+6400	75200	81600	53.445	+0.100	53.50	74400	2.14	3.08	.94
2	50.49	50.455	+.055	+3400	76000	79400	53.545	+.060	53.58	75000	2.15	3.09	.94
3	50.53	50.510	+.065	+4000	76400	80400	53.605	+.070	53.64	75400	2.15	3.11	.96
4	50.62	50.575	+.130	+8000	77100	85100	53.715	+.140	53.74	76000	2.16	3.12	.96
5	50.74	50.705	+.220	+13500	78100	91600	53.815	+.220	53.92	77200	2.19	3.13	.94
6	51.06	50.925	+.275	+16400	80000	96900	54.035	+.270	54.17	78900	2.21	3.11	.90
7	51.34	51.200	+.240	+14800	82100	96900	54.305	+.250	54.43	80600	2.24	3.09	.85
8	51.54	51.440	+.150	+9300	83000	92300	54.555	+.150	54.63	82000	2.26	3.09	.83
9	51.64	51.590	+.050	+3100	84100	87200	54.705	+.070	54.74	82700	2.27	3.10	.83
10	51.64	51.640	-.010	-600	84300	83700	54.765	.000	54.76	82800	2.28	3.12	.84
11	51.62	51.630	+.045	+2800	84300	87100	54.765	+.060	54.80	83100	2.29	3.18	.89
12	51.73	51.675	+.110	+6800	85400	92200	54.825	+.120	54.88	83600	2.30	3.15	.85
13	52.04	51.885	+.410	+25500	87600	113100	54.945	+.410	55.15	85500	2.32	3.11	.79
14	52.55	52.295	+.560	+35000	91000	126200	55.355	+.520	55.14	88800	2.34	3.09	.75
15	53.16	52.855	+.625	+39400	95600	135000	55.915	+.620	56.53	92800	2.45	3.06	.61
16	53.80	53.480	+.660	+41900	101000	142900	56.535	+.670	56.97	97400	2.52	3.07	.55
17	54.48	54.140	+.685	+44000	106700	150700	57.205	+.710	57.56	102300	2.60	3.08	.48
18	55.17	54.825	+.675	+43800	112700	156500	57.915	+.720	58.28	107500	2.68	3.11	.43
19	55.83	55.500	+.635	+41600	118100	159700	58.635	+.690	58.98	112600	2.76	3.15	.39
20	56.44	56.135	+.620	+40900	123400	164300	59.325	+.680	59.66	117600	2.84	3.22	.38
21	57.07	56.755	+.605	+40100	129200	169300	60.005	+.670	60.34	122800	2.91	3.27	.36
22	57.65	57.360	+.485	+32300	134200	166500	60.675	+.550	60.95	127400	2.98	3.30	.32
23	58.04	57.845	+.280	+18600	137600	156200	61.225	+.350	61.40	130900	3.02	3.36	.34
24	58.21	58.125	+.095	+6300	139200	145500	61.575	+.170	61.66	132900	3.05	3.45	.40
25	58.23	58.220	-.030	-2000	139400	137400	61.745	+.030	61.76	133700	3.06	3.53	.47
26	58.15	58.190	-.135	-9000	138300	129300	61.775	-.080	61.74	133500	3.06	3.59	.53
27	57.96	58.055	-.215	-14300	137100	122800	61.645	-.160	61.62	132600	3.05	3.66	.61
28	57.72	57.840	-.250	-16600	134900	118300	61.535	-.200	61.44	131200	3.03	3.72	.69
29	57.46	57.540	-.225	-15000	132600	117600	61.335	-.200	61.24	129600	3.01	3.78	.77
30	57.27	57.365	-.155	-10300	130700	120400	61.135	-.140	61.06	128300	2.99	3.74	.90

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. T.13 4 of 4
Washington
District

KOOTENAY LAKE STORAGE COMPUTATIONS JULY 1950

Day	Actual Conditions					Total supply in cfs	1929 Outlet Conditions				Required Lowering	Actual Lowering
	Elev at Queens Mean for day	Bay Start of day	Change during day	Equiv change in cfs	Discharge at Grohman in cfs		Elev at Queens Start of day	Bay change during day	Mean for day	Discharge At Nelson in cfs		
1	57.15	57.210	-0.120	-8000	129500	121500	60.995	-0.100	60.94	127300	2.98	3.79
2	57.03	57.090	-.115	-7600	128400	120800	60.895	-.100	60.84	126600	2.97	3.81
3	56.87	56.975	-.115	-7600	127400	119800	60.795	-.110	60.74	125800	2.95	3.82
4	56.80	56.860	-.135	-8900	126300	117400	60.685	-.130	60.62	124900	2.94	3.82
5	56.65	56.725	-.165	-10900	124800	113900	60.555	-.170	60.47	123800	2.93	3.82
6	56.47	56.560	-.195	-12900	123200	110300	60.385	-.200	60.28	122300	2.91	3.81
7	56.26	56.365	-.235	-15500	121300	105800	60.185	-.230	60.07	120700	2.88	3.81
8	56.00	56.130	-.270	-17700	120400	102700	59.955	-.260	59.82	118800	2.85	3.82
9	55.72	55.860	-.275	-18000	117500	99500	59.695	-.280	59.56	116900	2.82	3.84
10	55.45	55.585	-.300	-19500	115100	95600	59.415	-.300	59.26	114700	2.80	3.81
11	55.12	55.285	-.375	-24300	112300	88000	59.115	-.380	58.92	112200	2.76	3.80
12	54.70	54.910	-.435	-28000	109300	81300	58.735	-.430	58.52	109200	2.70	3.82
13	54.25	54.475	-.465	-29800	106000	76200	58.305	-.460	58.08	106000	2.65	3.83
14	53.77	54.010	-.475	-30200	101500	71300	57.845	-.490	57.60	102600	2.60	3.83
15	53.30	53.535	-.475	-30000	97000	67000	57.355	-.500	57.10	99000	2.55	3.80
16	52.82	53.060	-.480	-30100	93200	63100	56.855	-.500	56.60	95500	2.50	3.78
17	52.34	52.580	-.470	-29300	89000	59700	56.355	-.500	56.10	92000	2.44	3.78
18	51.88	52.110	-.445	-27600	85000	57400	55.855	-.490	55.61	88600	2.38	3.73
19	51.45	51.665	-.420	-26000	81200	55200	55.365	-.470	55.13	85300	2.32	3.68
20	51.04	51.245	-.405	-24900	77900	53000	54.895	-.460	54.66	82200	2.27	3.62
21	50.64	50.840	-.395	-24200	74700	50500	54.435	-.460	54.20	79100	2.21	3.56
22	50.25	50.445	-.380	-23200	71800	48600	53.975	-.440	53.76	76200	2.16	3.51
23	49.88	50.065	-.370	-22500	69200	46700	53.535	-.430	53.32	73300	2.11	3.44
24	49.51	49.695	-.360	-21900	66000	44100	53.105	-.430	52.89	70500	2.06	3.38
25	49.16	49.335	-.335	-20300	63600	43300	52.675	-.400	52.48	67900	2.01	3.32
26	48.84	49.000	-.295	-17800	61400	43600	52.275	-.360	52.10	65400	1.99	3.25
27	48.57	48.705	-.270	-16300	59900	43600	51.915	-.330	51.75	63200	1.95	3.18
28	48.30	48.435	-.280	-16900	59600	42700	51.585	-.310	51.43	61200	1.92	3.13
29	48.01	48.155	-.285	-17200	58400	41200	51.275	-.300	51.12	59300	1.88	3.11
30	47.73	47.870	-.305	-18300	57300	39000	50.975	-.310	50.82	57500	1.89	3.09
31	47.40	47.565	-.325	-19500	55300	35800	50.665	-.330	50.50	55500	1.81	3.10

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UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TABLE 14
File No. | Washington
District

KOOTENAY LAKE AT QUEENS BAY — 1950 — Summary of Storage Computations (WKP&L Co.)

Day	April			May			June			July		
	Total Supply	Computed Natural Elev.-QB	Required Lowering Actual	Total Supply	Computed Natural Elev.-QB	Required Lowering Actual	Total Supply	Computed Natural Elev.-QB	Required Lowering Actual	Total Supply	Computed Natural Elev.-QB	Required Lowering Actual
1	12,800	41.40	2.08 2.29	26,300	44.81	1.27 3.65	87,200	54.14	2.20 3.72	124,700	61.42	3.01 4.27
2	13,700	41.44	1.00 2.41	25,500	44.82	1.27 3.67	84,200	54.24	2.21 3.75	124,400	61.32	3.00 4.29
3	15,300	41.50	1.01 2.50	27,000	44.84	1.27 3.69	84,600	54.30	2.22 3.77	123,200	61.20	2.99 4.28
4	15,300	41.56	1.02 2.57	27,900	44.88	1.28 3.71	90,900	54.42	2.23 3.80	120,700	61.08	2.98 4.28
5	15,400	41.62	1.02 2.66	27,600	44.92	1.28 3.71	96,800	54.60	2.25 3.81	118,400	60.94	2.96 4.29
6	15,100	41.68	1.02 2.73	28,100	44.96	1.28 3.72	102,300	54.86	2.29 3.80	114,800	60.78	2.95 4.31
7	14,600	41.72	1.03 2.88	27,100	44.99	1.29 3.73	102,700	55.13	2.32 3.79	110,000	60.58	2.93 4.32
8	15,400	41.76	1.03 2.86	28,300	45.02	1.24 3.75	97,900	55.34	2.34 3.80	103,900	60.31	2.90 4.31
9	15,300	41.82	1.04 2.92	30,900	45.08	1.30 3.77	92,800	55.46	2.36 3.82	102,000	60.02	2.87 4.30
10	15,000	41.86	1.04 2.98	37,000	45.20	1.30 3.79	89,000	55.49	2.37 3.85	98,500	59.72	2.83 4.27
11	15,600	41.90	1.05 3.04	44,600	45.43	1.32 3.82	92,700	55.52	2.37 3.90	90,700	59.38	2.80 4.26
12	16,200	41.96	1.05 3.11	56,700	45.80	1.34 3.84	103,200	55.66	2.39 3.93	81,500	58.95	2.76 4.25
13	19,300	42.04	1.05 3.16	72,100	46.36	1.40 3.82	118,800	55.96	2.43 3.92	75,500	58.46	2.69 4.21
14	21,200	42.16	1.07 3.21	87,500	47.12	1.47 3.77	132,200	56.45	2.49 3.90	72,300	57.95	2.65 4.18
15	24,900	42.31	1.08 3.24	97,700	48.01	1.56 3.70	140,300	57.04	2.55 3.88		57.44	
16	27,100	42.50	1.10 3.26	104,100	48.96	1.66 3.66	147,700	57.68	2.62 3.88	63,900	56.92	2.54 4.10
17	29,900	42.74	1.11 3.29	103,800	49.85	1.75 3.62	155,100	58.35	2.68 3.87	60,600	56.40	2.48 4.06
18	32,300	43.00	1.13 3.32	99,200	50.62	1.83 3.60	160,700	59.05	2.77 3.88	57,800	55.88	2.42 4.00
19	32,500	43.26	1.15 3.35	89,900	51.21	1.89 3.59	164,300	59.74	2.84 3.91	56,500	55.39	2.35 3.94
20	31,900	43.49	1.17 3.37	80,800	51.60	1.93 3.61	168,700	60.40	2.91 3.96	55,000	54.92	2.30 3.88
21	32,700	43.71	1.19 3.41	76,000	51.84	1.95 3.65	172,300	61.04	2.98 3.97	52,400	54.46	2.24 3.82
22	34,400	43.94	1.20 3.44	74,700	52.00	1.97 3.67	168,900	61.62	3.02 3.97	51,000	54.03	2.19 3.78
23	34,800	44.16	1.22 3.46	78,400	52.18	1.99 3.71	159,000	62.03	3.09 3.99	48,900	53.61	2.14 3.73
24	32,500	44.35	1.23 3.47	80,800	52.38	2.01 3.70	148,700	62.26	3.11 4.05	45,900	53.18	2.09 3.67
25	31,400	44.50	1.25 3.50	79,700	52.56	2.03 3.69	140,200	62.33	3.11 4.10	44,900	52.77	2.05 3.61
26	29,700	44.62	1.25 3.52	81,900	52.74	2.05 3.72	133,100	62.28	3.11 4.13	45,400	52.39	2.01 3.55
27	28,200	44.70	1.26 3.55	86,800	52.95	2.07 3.72	125,400	62.14	3.09 4.18	46,500	52.06	1.98 3.49
28	27,300	44.76	1.27 3.58	90,900	53.21	2.10 3.71	121,600	61.94	3.08 4.22	45,100	51.75	1.95 3.45
29	25,900	44.78	1.27 3.61	97,600	53.52	2.13 3.73	120,100	61.72	3.04 4.26	42,900	51.44	1.92 3.43
30	25,700	44.80	1.27 3.63	92,800	53.82	2.16 3.75	123,900	61.55	3.02 4.28	40,600	51.14	1.89 3.41
31				87,600	54.01	2.18 3.73				38,100	50.82	1.86 3.42

Data from weekly log sheets, Kootenay Lake and River.

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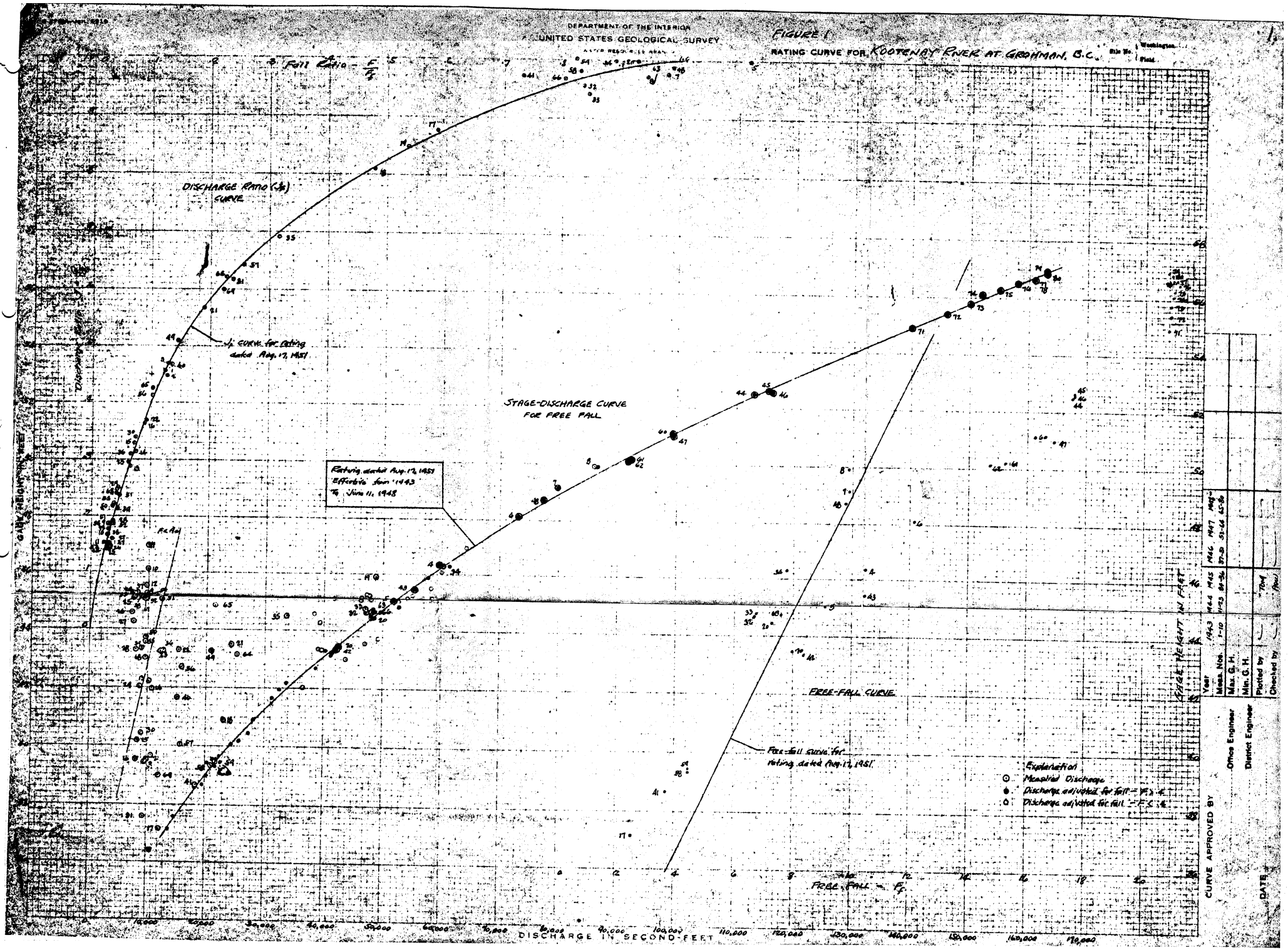

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
FIGURE 1
RATING CURVE FOR KOOTENAY RIVER AT GROHMAN, B.C.
Fall Ratio = F/f
DISCHARGE RATIO (F/f) CURVE
STAGE-DISCHARGE CURVE FOR FREE FALL
Rating dated Aug. 17, 1951
Effective from 1943
To June 11, 1948
FREE-FALL CURVE
Free-fall curve for rating dated Aug. 17, 1951.
Explanation
Measured Discharge
Discharge adjusted for fall = F/f = 1
Discharge adjusted for fall = F/f < 1
GAGE HEIGHT IN FEET
DISCHARGE IN SECOND-FEET
FREE FALL = F/f
CURVE APPROVED BY
Office Engineer
District Engineer
DATE
Year
Meas. Nos.
Max. G. H.
Min. G. H.
Plotted by
Checked by

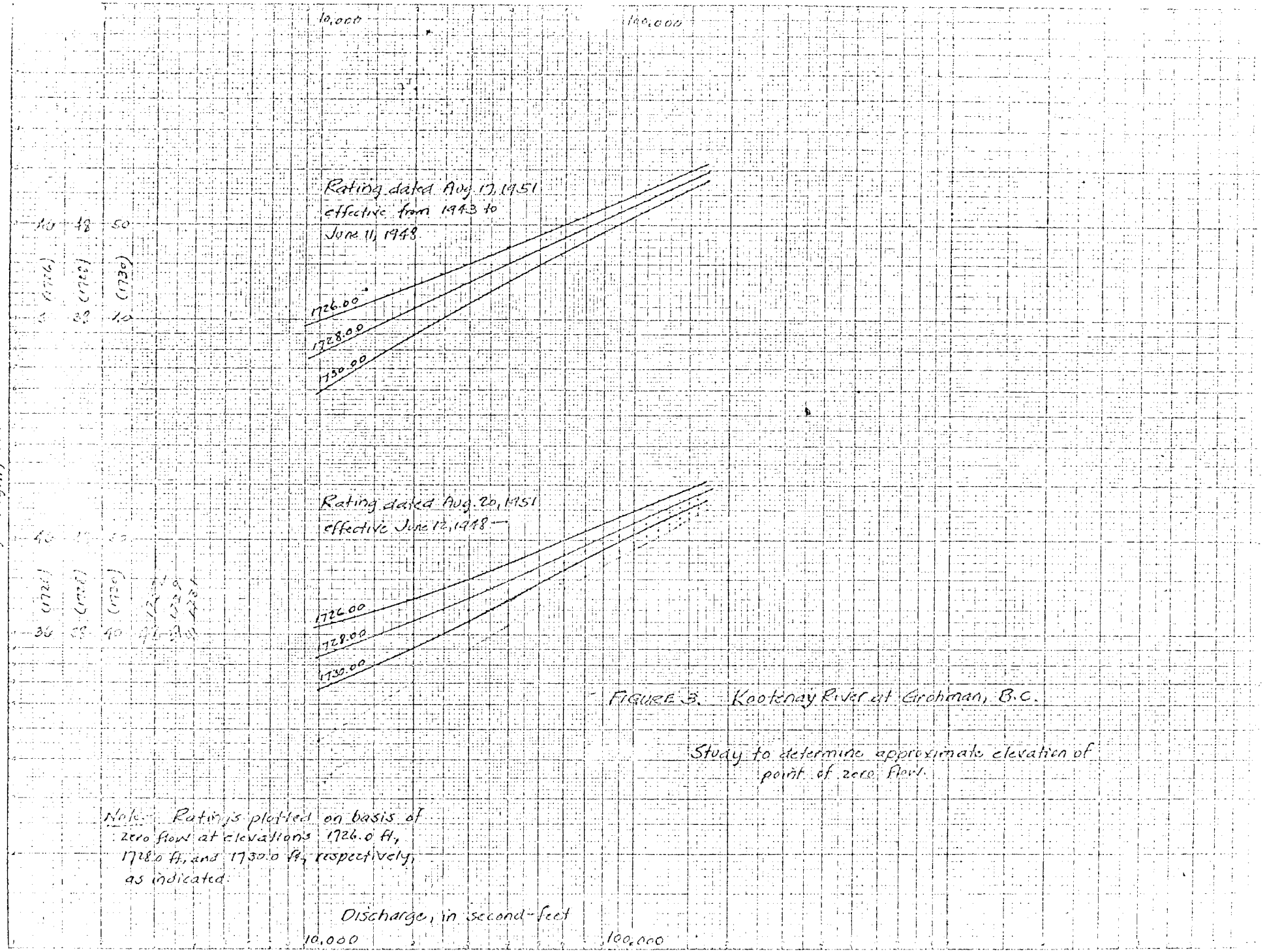


FIGURE 3. Kootenay River at Grohman, B.C.

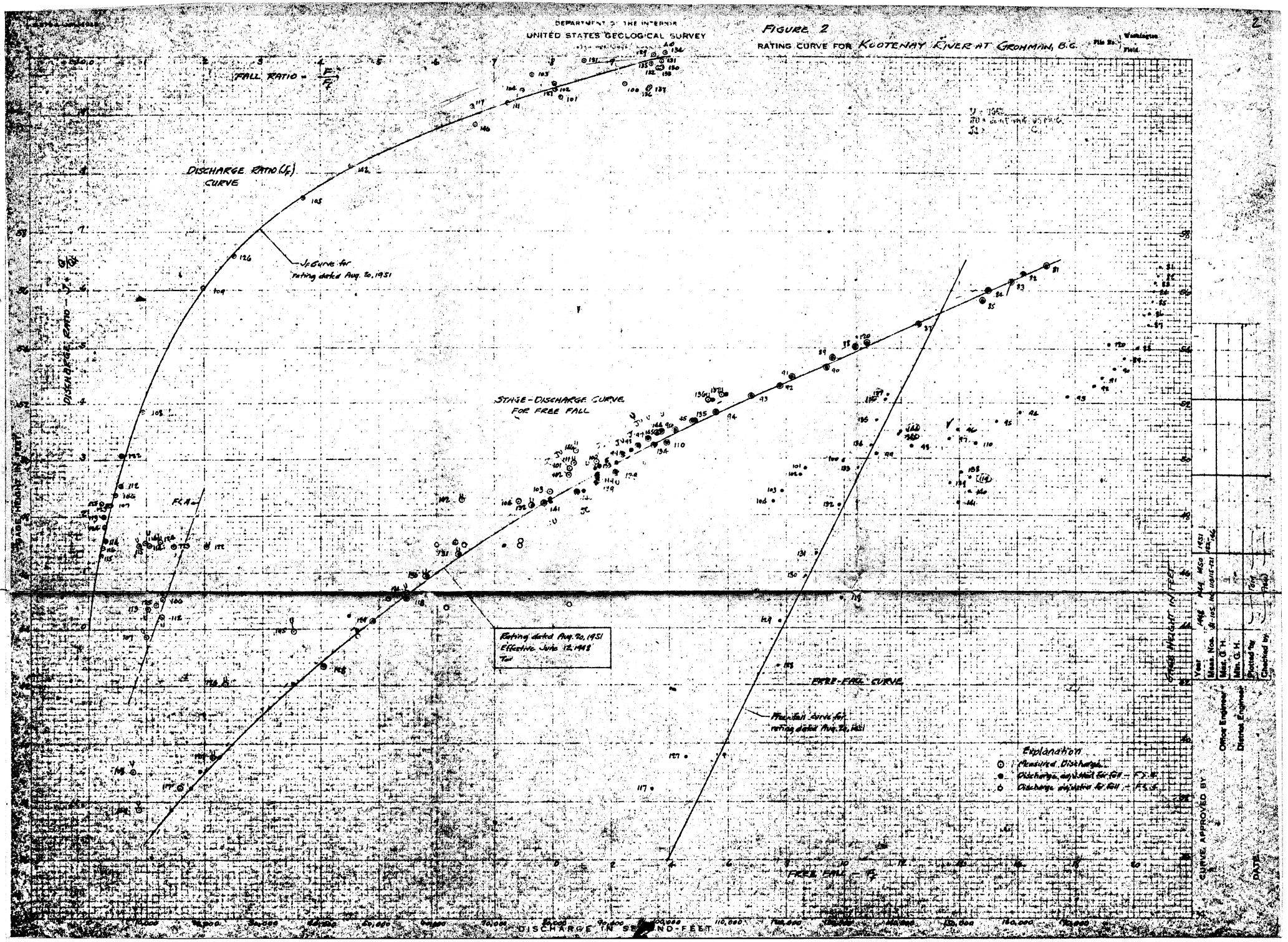
Study to determine approximate elevation of point of zero flow.

Note: Rating is plotted on basis of zero flow at elevations 1726.0 ft, 1728.0 ft, and 1730.0 ft, respectively, as indicated.

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

FIGURE 2

RATING CURVE FOR KOOTENAY RIVER AT GRONMAN, B.C.



CURVE APPROVED BY
Officer Engineer
District Engineer
DATE

Year	1948	1951
Meas. Nos.	8-105, 107-121	122-146
Max. G. H.		
Min. G. H.		
Plotted by		
Checked by		

FIGURE 5.

HYDROGRAPH FOR KOOTENAY LAKE AT QUEENS BAY — 1950

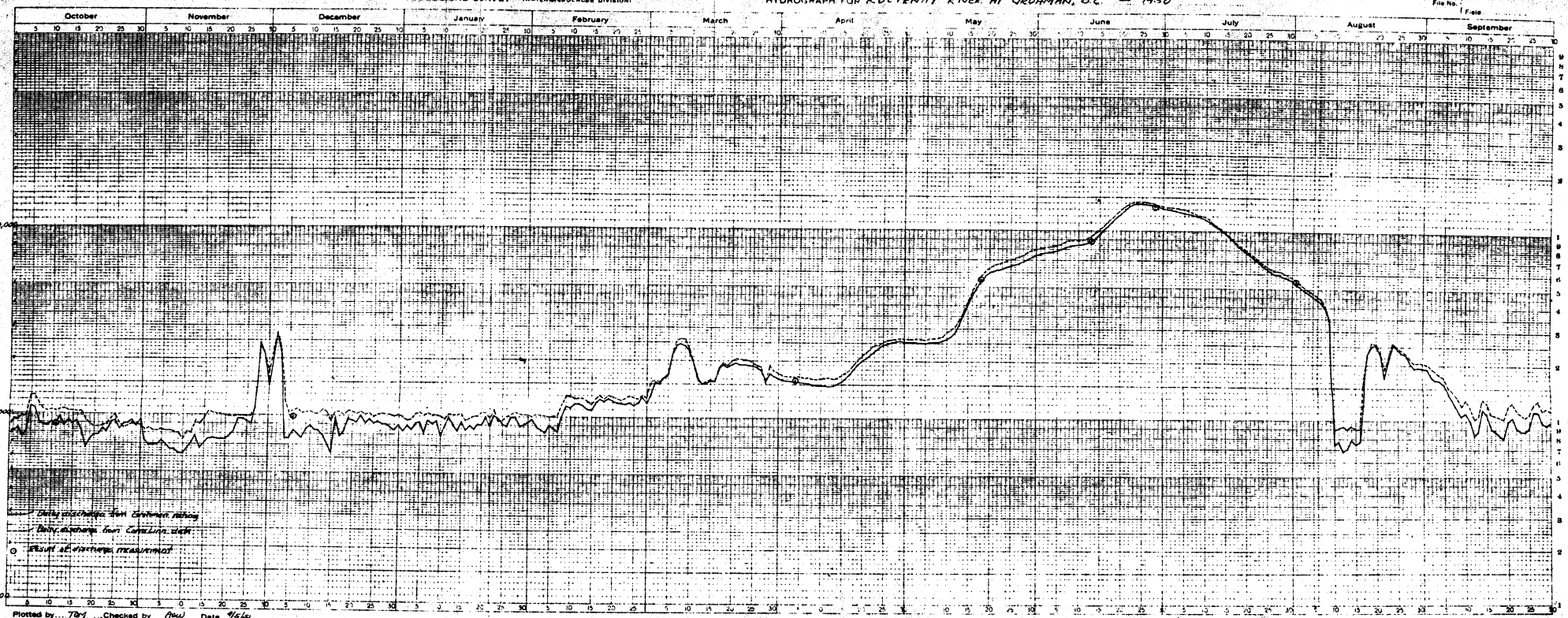
9-284 April 1938

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY (WATER-RESOURCES DIVISION)

FIGURE 4.

HYDROGRAPH FOR KOOTENAY RIVER AT GROHMAN, B.C. — 1950

File No. Washington / F-sio



Plotted by... TDM ...Checked by AEW ...Date...9/5/50