SKOKOMISH-DOSEWALLIPS BASIN
WRIA 16
Technical Document

Office Report No. 74

Water Resources Technical Group
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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. Introduction

The Western Washington Instream Resource Protection Program involves development of instream flow regulations under Chapter 90.54 RCW (Water Resources Act of 1971) and Chapter 173-500 WAC for the 26 Water Resource Inventory Areas (WRIA) found on the western slope of the Cascade Range.

State law provides that perennial streams and rivers shall be retained with base flows necessary to provide for preservation of wildlife, fish, scenic, aesthetic, and other environmental and navigational values (Chapter 90.54.020(e)(a) RCW, 1971). Base flows are broadly interpreted as lower levels of flow that occur naturally in a stream. Each stream selected for regulation is rated by state resource agencies. A high rated stream having greater environmental and scenic values will require higher levels of base flow. The Instream Resource Protection Program (base flows) does not affect any existing water rights and uses.

II. Basin Description

The Skokomish-Dosewallips Basin is located west of the Seattle Metropolitan area on the Olympic Peninsula. The majority of it is contained in Mason County with smaller portions in both Jefferson and Grays Harbor counties. The basin area is 550 square miles. The majority of this area is covered by forest with only small percentages used for farming and residence. The topography is jagged peaks of the eastern slopes of the Olympic Mountains in western and central portions of the basin easing down to foothills near the eastern side bordering Hood Canal. It contains parts of both the Olympic National Forest and the Olympic National Park. Precipitation is approximately 80 to 140 inches per year with the higher elevations receiving an even greater amount. Land use activities affecting water resources are mainly forestry with some agriculture. The population of the basin was approximately 7,000 in 1978.

The Skokomish-Dosewallips Basin consists of four major rivers and several smaller streams. These four major rivers, the Skokomish, the Hamma Hamma, the Duckabush, and the Dosewallips each reach far into the Olympic Mountains and drain large areas.

The Department of Ecology concludes that a set of 9 control stations will provide adequate managerial control over future diversions of the surface water resources. In addition to the four major streams previously named five smaller streams will also be monitored. Table 1 and Figure 1 display the regulatory control network of the Skokomish Basin Instream Resource Protection Program.

Table 1

List of Proposed Control Stations (DOE)

	Control Location Gage Number River Mile	Stream Management Reach
A.	Purdy Creek 12-0625.00 1.2	Mouth to headwaters
B.	Skokomish River 12-0615.00 5.3	From influence of mean annual high tide at low instream flow levels to headwater except Purdy Cr.
C.	Hamma Hamma River 12-0545.00 6.2	From influence of mean annual high tide at low instream flow levels to headwaters.
D.	Duckabush River 12-0540.00 4.5	From influence of mean annual high tide at low instream flow levels to headwaters.
E.	Dosewallips River 12-0530.00 7.0	From influence of mean annual high tide at low instream flow levels to headwaters.
F.	Finch Creek - 0.1	From influence of mean annual high tide at low instream flow levels to headwaters.
G.	Eagle Creek - 0.1	From influence of mean annual high tide at low instream flow levels to headwaters.
H.	Lilliwaup Creek - 0.1	From influence of mean annual high tide at low instream flow levels to headwaters.
I.	Little Lilliwaup Creek - 0.1	From influence of mean annual high tide at low instream flow levels to headwaters.

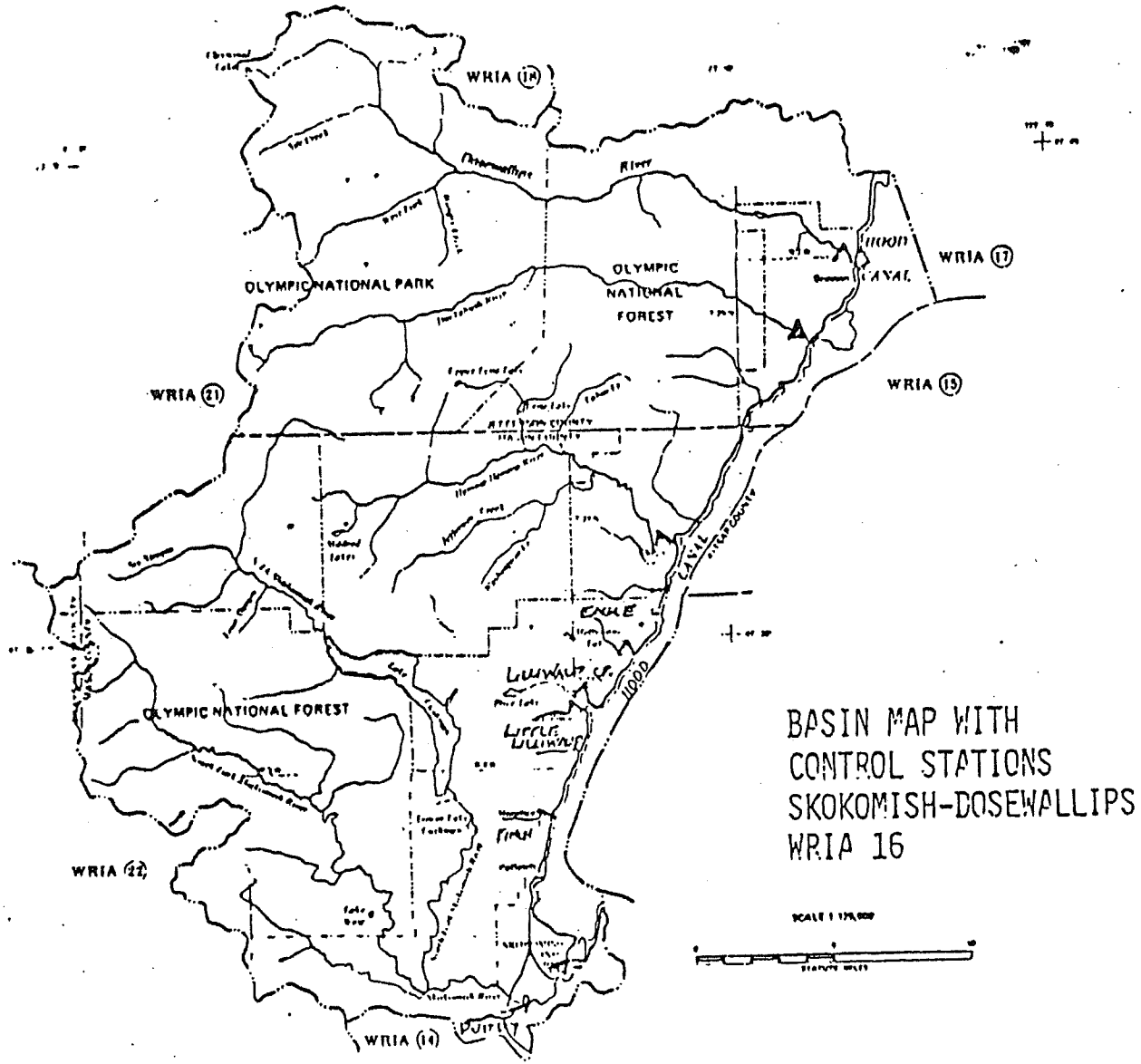

WRIA (18)
OLYMPIC NATIONAL PARK
OLYMPIC NATIONAL FOREST
WRIA (17)
WRIA (21)
WRIA (15)
OLYMPIC NATIONAL FOREST
WRIA (22)
WRIA (14)
BASIN MAP WITH
CONTROL STATIONS
SKOKOMISH-DOSEWALLIPS
WRIA 16

Figure 1

III. Stream Management Reach Information

A. Purdy Creek

Purdy Creek originates in the central portions of Mason County flowing north then east to join the Skokomish River at River Mile 4.1. It drains an area of 4.33 square miles. At the gage, the drainage area is 1.43 square miles. The minimum recorded discharge is 5.9 cfs on December 9, 1959. The maximum recorded discharge is 111 cfs on December 15, 1959. The period of record is September 1954 to July 1960. The record is poor with the flow affected by springs and a fish hatchery.

B. Skokomish River

The Skokomish River originates in the northwestern regions of Mason County flowing southeast as the north and south forks. After converging, the mainstem flows east to Hood Canal between Potlach and Union. It drains 227 square miles at the gage with an average discharge of 1201 cfs. The maximum recorded discharge is 24,200 cfs on November 3, 1955. The minimum recorded discharge is 126 cfs on September 15, 1944. The period of record is from July 1943 to current date.

C. Hamma Hamma River

The Hamma Hamma River originates in the north central regions of Mason County and flows east to Hood Canal at Eldon. It drains 51.3 square miles at river mile 6.2. It has an average discharge of 364 cfs. The maximum recorded discharge is 4500 cfs on January 14, 1968. The minimum discharge is 39 cfs on October 1, 1965. The period of record is from July 1951 to June 1971.

D. Duckabush River

The Duckabush River originates in south central Jefferson County and flows east into Hood Canal at a location 2 miles south of Brinnon. It drains an area of 66.5 square miles at river mile 4.5 and has an average discharge of 416 cfs. The maximum recorded discharge is 4990 cfs on January 14, 1978. The minimum recorded flow is 46 cfs on October 8, 1938. The period of record is July 1938 to current date.

E. Dosewallips River

The Dosewallips River originates in the north central section of Jefferson County and flows east to Hood Canal at Brinnon. It drains an area of 93.5 square miles at River Mile 7.0. Its average discharge is 446 cfs. The maximum recorded discharge is 5,510 cfs on November 15, 1934. The minimum recorded discharge is 67 cfs on December 3, 1936. The period of record is October 1930 through September 1949 and June 1951 through September 1951.

F. Finch Creek

Finch Creek originates in the northeastern section of Mason County just east of Lake Cushman. It flows east into Hood Canal at Hoodsport. It drains an area of 3.52 square miles. The minimum recorded discharge is 11 cfs on August 31, 1951. There is miscellaneous flow data for 1911, 1922, and 1951. This stream is correlated to the Skokomish River for hydrologic base flow determination.

G. Eagle Creek

Eagle Creek originates in northwestern Mason County and flows southeast into Hood Canal about a mile north of Lilliwaup. It drains an area of 6.90 square miles. The minimum recorded discharge is 6.9 cfs on September 20, 1951. There is miscellaneous flow data for 1951 and 1953. This stream is correlated to the Skokomish River for hydrologic base flow determination.

H. Lilliwaup Creek

Lilliwaup Creek originates in northwestern Mason County near Price Lake. From there it flows east into Lilliwaup Bay on Hood Canal. It drains an area of 15.1 square miles. The minimum recorded discharge is 10.2 cfs on September 30, 1943. There is some miscellaneous flow data for the years of 1924, 1925, 1926, 1931, 1943, 1951. Not enough information is available from which to make a hydrologic base flow determination.

I. Little Lilliwaup Creek

Little Lilliwaup Creek originates southwest of Lilliwaup and flows east into Hood Canal about 1/2 mile south of Lilliwaup. It drains an area of 1.51 square miles. The minimum recorded discharge is 4.15 cfs on September 5, 1951. There is some miscellaneous data for the year of 1951. Not enough information is available from which to make a hydrologic base flow determination.

IV. Hydrologic Base Flow Analysis

The hydrologic base flows for this basin have been determined in accordance with WRIS Technical Bulletin No. 11 dated January 1976. When a stream did not have a long enough record to produce a hydrograph, a linear correlation was done against a stream with longer record. Different flows for the same dates were plotted against each other (a flow vs. flow graph, see figures 9 and 10) and the best fit line was drawn. From this line, the y-intercept and the slope can be calculated and a flow relation equation developed. The stream ratings used in the analysis are shown on Table 2. The flow relation equations are shown on Table 3. The results of the instream flow analysis are displayed in numerical and graphical form on Table 4 and Figures 2-8.

In the past, the Department of Ecology has placed special restrictions on appropriation from specific streams when such restrictions were recommended by the departments of Fisheries and/or Game in accordance with Chapter 75.20 RCW. The current administrative status of the streams and lakes in the Skokomish Water Resource Inventory Area is shown on Table 5.

Table 2. STREAM RATINGS IN WRIA NO. 16 (SKOKOMISH - DOSEWALLIPS)

Control Station Stream Name (Non-Standard Reach Description)	Number River Mile Sec Twp Rge	Stream Rating						
		Wildlife	Fish	Scenic & Aesthetic	Navigation	Other Environments	Quality Standards	Total Rating
Purdy Creek (from mouth to headwaters)	12-0625-00 14, 21N, 4W	4	4	2.25	0	1	3	14.25 78%
Skokomish River (from influence of mean annual high tide at low instream flow to headwaters)	12-0615-00 5.3 4, 23N, 5W	4	4	3	2	3	3	19 69%
Hamma Hamma River (from influence of mean annual high tide at low instream flow to headwaters)	12-0545-00 6.2 7, 24N, 3W	4	4	4	0.66	3.33	4	20 67%
Duckabush River (from influence of mean annual high tide at low instream flow to headwaters)	12-0540-00 4.5 1, 25N, 3W	4	4	3.25	1	3.33	3	18.58 70%
Dosewallips River (from influence of mean annual high tide at low instream flow to headwaters)	12-0530-00 7.0 24, 26N, 3W	4	4	4	1	3.33	3	19.33 69%
Finch Creek (from influence of mean annual high tide at low instream flow to headwaters)	0.1 11, 22N, 4W	3	4	1.5	0	1	3	12.5 81%
Eagle Creek (from influence of mean annual high tide at low instream flow to headwaters)	0.1 16, 23N, 3W	3	4	2.25	0	1	3	13.25 80%
Lilliwaup Creek (from influence of mean annual high tide at low instream flow to headwaters)	0.1 13, 23N, 4W	3	4	3	0	1.66	3	14.66 77%
Little Lilliwaup Creek (from influence of mean annual high tide at low instream flow to	0.1 30, 23N, 3W	3	4	1.5	0	1	3	12.5 81%

Table 3

Flow Relation Equations

A. Purdy Creek near Union

Hydrograph available

B. Skokomish River near Potlach

Hydrograph available

C. Hamma Hamma River near Eldon

Hydrograph available

D. Duckabush River near Brinnon

Hydrograph available

E. Dosewallips River near Brinnon

Hydrograph available

F. Finch Creek

Flow of Finch Creek = 0.022 X Flow of Skokomish River + 7.96 cfs

Correlation = 97%

G. Eagle Creek

Flow of Eagle Creek = 0.012 X Flow of Skokomish River + 5.27 cfs

Correlation = 94%

H. Lilliwaup Creek

Not sufficient information from which to prepare a meaningful hydrograph.

I. Little Lilliwaup Creek

Not sufficient information from which to prepare a meaningful hydrograph.

Table 4. HYDROLOGIC BASE FLOWS FOR WRIA NO. 16 (SKOKOMISH)

	JAN		FEB		MAR		APR		MAY		JUN		JUL		AUG		SEP		OCT		NOV		DEC	
	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15
Purdy Creek	18	20	23	26	30	28	27	25	23	22	20	19	18	17	16	15	14	13	13	13	13	13	16	16
Skokomish River	560	560	560	560	560	560	560	560	560	560	465	385	320	260	220	180	180	180	180	225	280	350	460	560
Hamma Hamma River	110	110	110	110	110	110	140	180	235	300	300	300	230	175	135	105	80	60	60	83	110	110	110	110
Ducksbush River	130	130	130	130	130	130	160	195	235	290	350	330	260	195	145	110	80	80	80	80	95	110	130	130
Dosewallips River	150	150	150	150	150	150	190	245	310	400	500	500	300	295	250	180	160	140	125	110	130	150	150	150
Finch Creek	20	20	20	20	20	20	20	20	20	18	17	16	15	14	13	12	12	12	12	13	15	16	18	20
Eagle Creek	12	12	12	12	12	12	12	12	12	11	10	9.5	9.0	8.5	8	7.5	7.5	7.5	7.5	8.5	9.6	10	11	12

Table 5. Current Administrative Status of Streams and Lakes - Skokomish - Dosewallips. WRIA 16

Stream	Tributary to	Action	Dates
McTaggart Creek	N. Fork Skokomish	Low Flow (2.0 cfs bypass)	2/9/53
Waketickch Creek	Hood Canal	Low Flow (0.60 cfs bypass)	7/27/59
Skokomish Indian Res. Waters	(Interim Procedures -Indian Water Rights)		12/23/75

CONVERSION TABLES

(U. S. and Metric)

VOLUME

Unit		Liters	U.S. Gallons	Cubic Feet	Cubic Meters	Acre-Feet
1 Liter	=	1.0	0.2642	0.0353	0.001	0.00000081
1 U.S. Gallon	=	3.785	1.0	0.134	0.00379	0.00000307
1 Cubic Foot (62.4 lbs water)	=	28.317	7.481	1.0	0.02832	0.0000230
1 Cubic Meter	=	1,000	264.2	35.315	1.0	0.0008107
1 Acre-Foot	=	1,233,500	325,851	43,560	1,233.5	1.0

1 U.S. Gallon = 231 cubic inches = 0.83 Imperial Gallons (= 8.3 pounds of water)

1 Liter = 1,000 cubic centimeters = 1.05 quarts (= 1,000 grams of water)

1 Cubic Hectometer = 810.7 acre-feet

RATE OF FLOW

Unit		gpm	cfs	mgd	cu m/sec	maf/yr
1 U.S. Gallon per Minute (gpm)	=	1.0	0.002228	0.001440	0.0000631	0.00000161
1 Cubic Foot per Second (cfs)	=	448.8	1.0	0.6463	0.02832	0.000724
1 Million U.S. Gallons per Day (mgd)	=	694.4	1.547	1.0	0.04381	0.00112
1 Cubic Meter per Second (cu m/sec)	=	15,850	35.31	22.82	1.0	0.0256
1 Million Acre-Feet per year (maf/yr)	=	619,960	1,381	892.9	39.1	1.0

1 Liter per second = 15.85 gallons per minute

1 Cubic Foot per Second = 1.98 acre-feet per day = 724 acre-feet per year

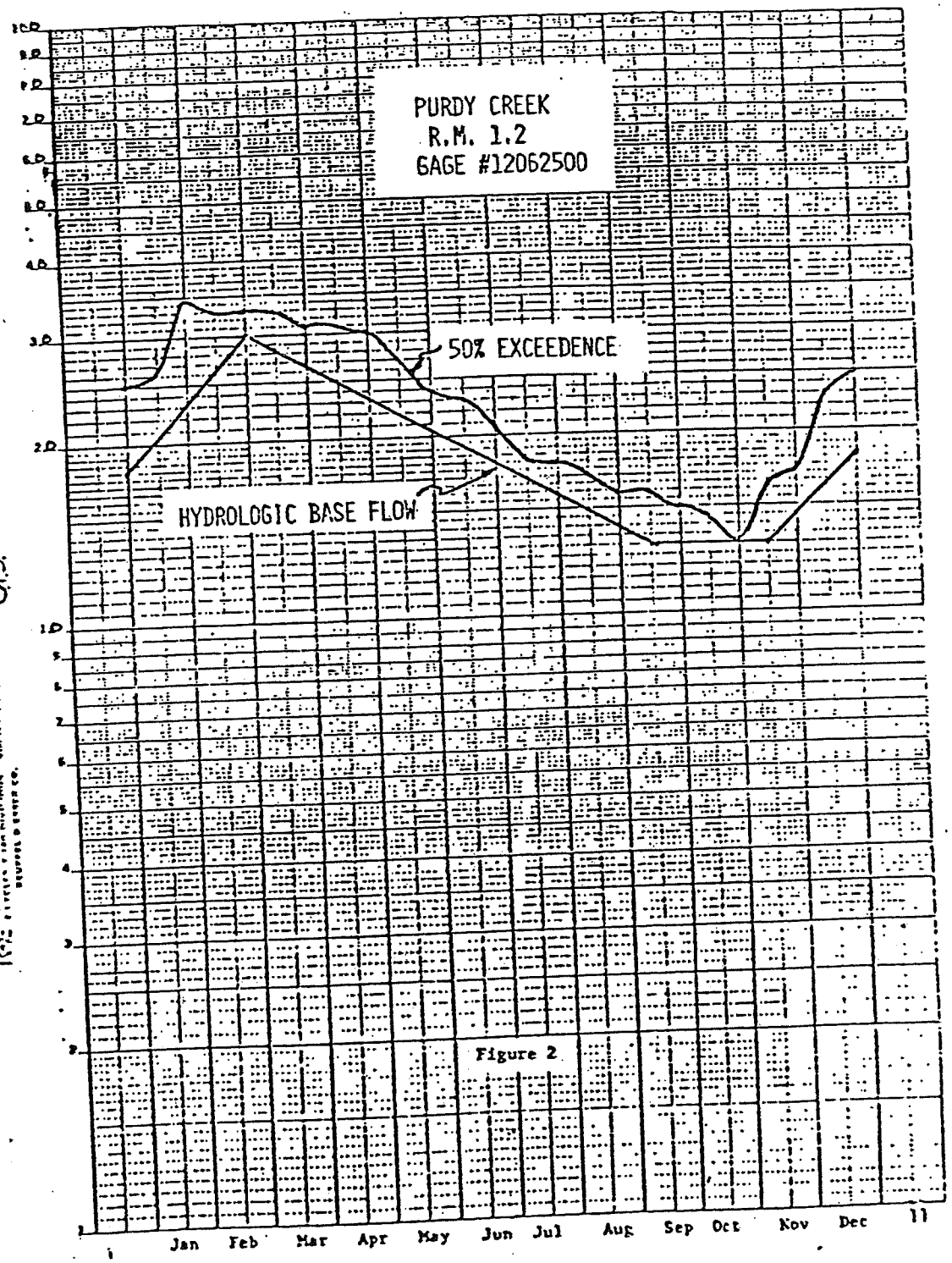
Other

1 Acre = 43,560 square feet (209 x 209 feet) = 0.405 hectare

1 Hectare = 10,000 square meters = 0.01 square kilometer = 2.47 acres

1 Kilowatt-hour (KWH) = 0.001 megawatt-hour (MWH) = 3,413 BTU

Table 6


PURDY CREEK
R.M. 1.2
GAGE #12062500
50% EXCEEDENCE
HYDROLOGIC BASE FLOW
C.F.S.
Jan
Feb
Mar
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May
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Jul
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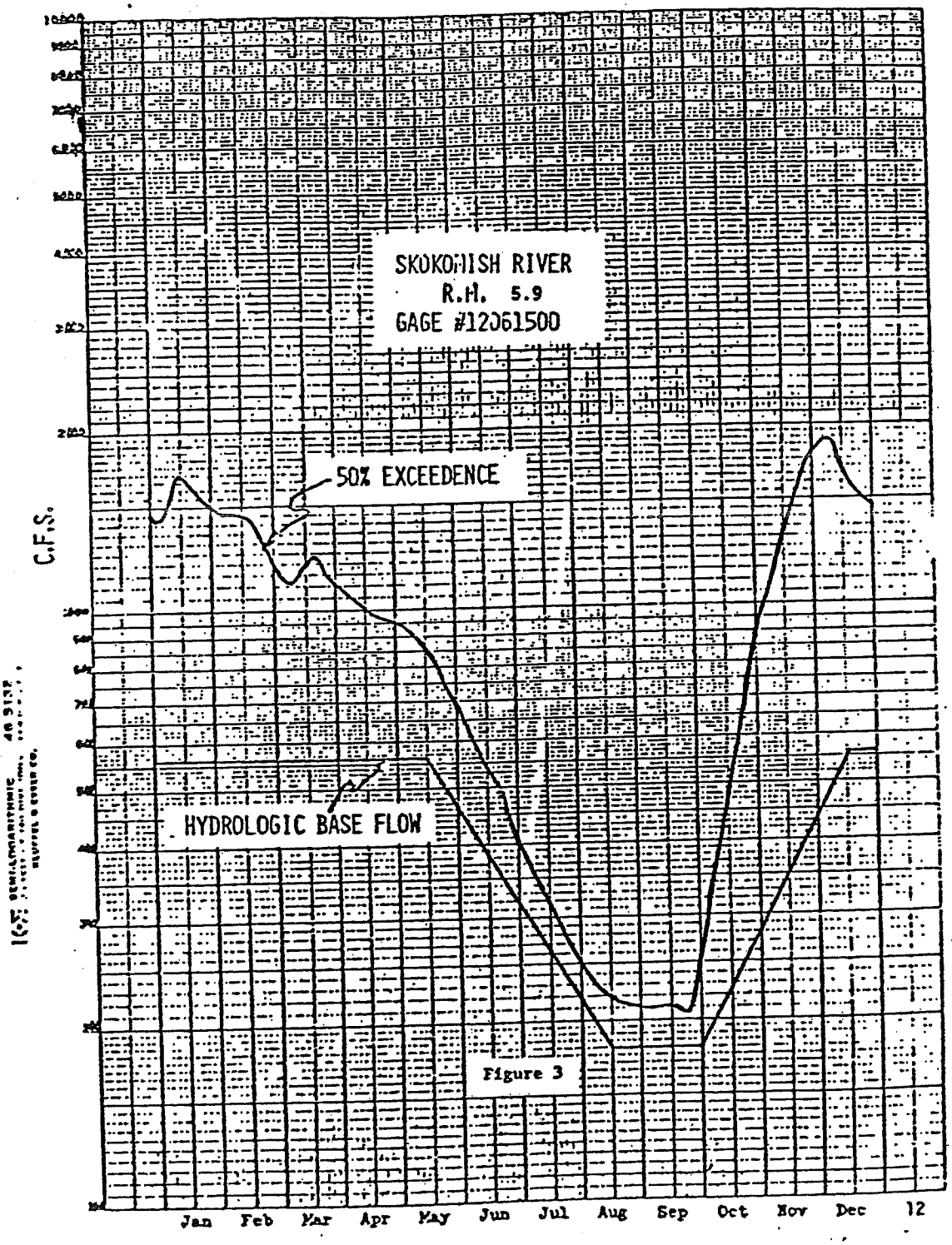
Oct
Nov
Dec

Figure 2


SKOKOMISH RIVER
R.M. 5.9
GAGE #12061500
50% EXCEEDENCE
HYDROLOGIC BASE FLOW
C.F.S.
Jan
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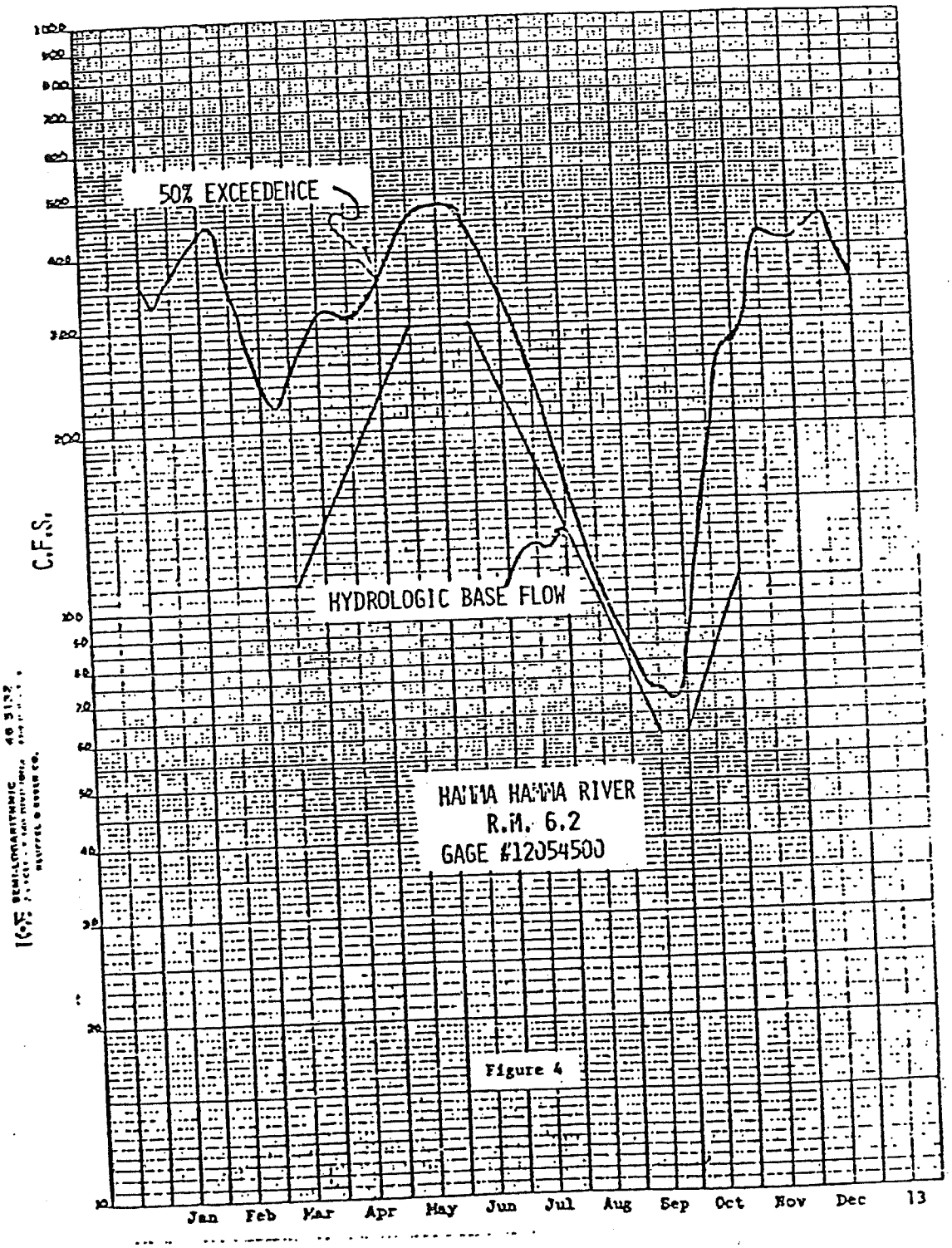
12

Figure 3


50% EXCEEDENCE
HYDROLOGIC BASE FLOW
C.F.S.
HAMMA HAMMA RIVER
R.M. 6.2
GAGE #12054500
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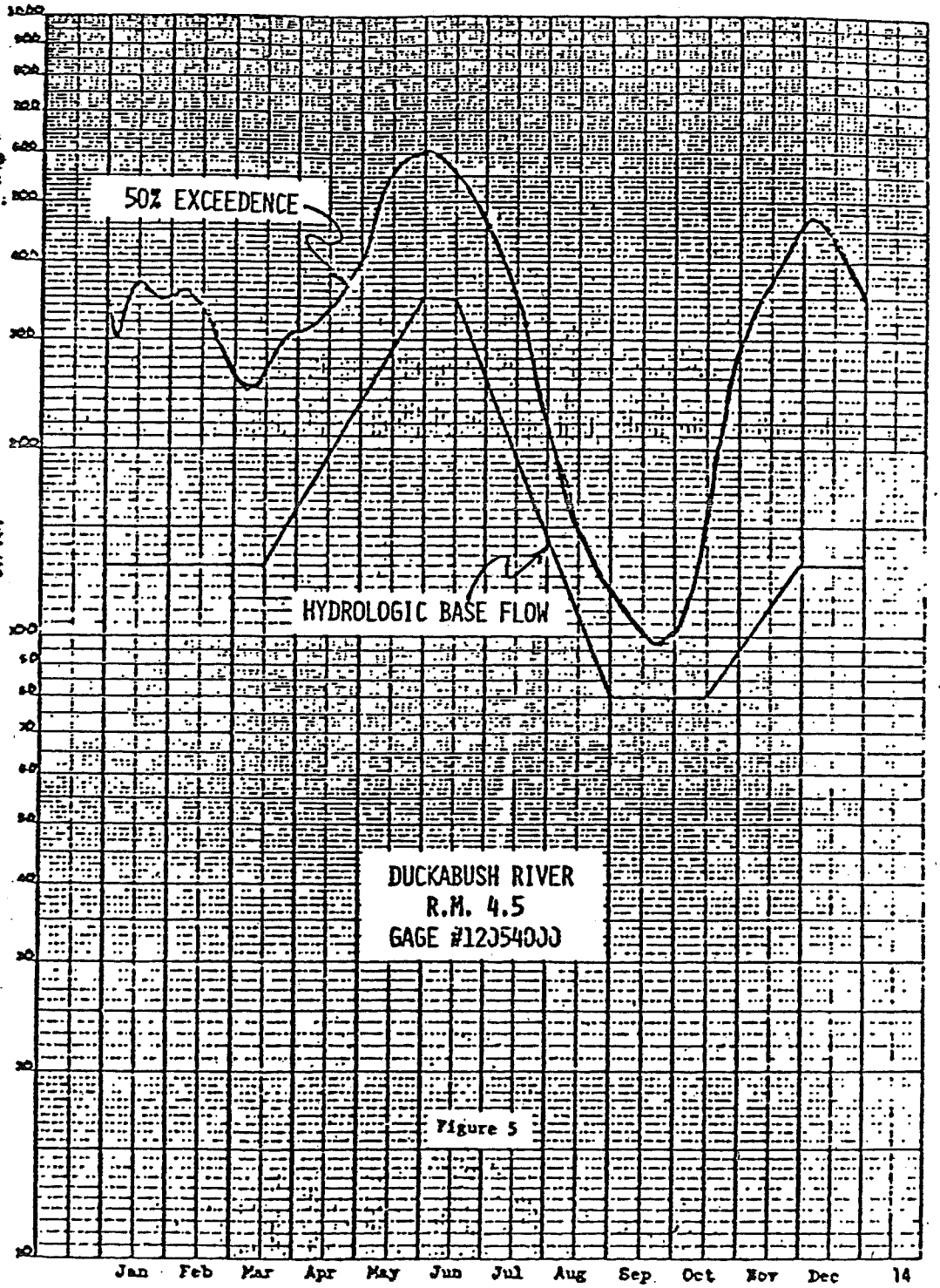
Nov
Dec

Figure 4


50% EXCEEDENCE
HYDROLOGIC BASE FLOW
C.F.S.
DUCKABUSH RIVER
R.M. 4.5
GAGE #12054000
Jan
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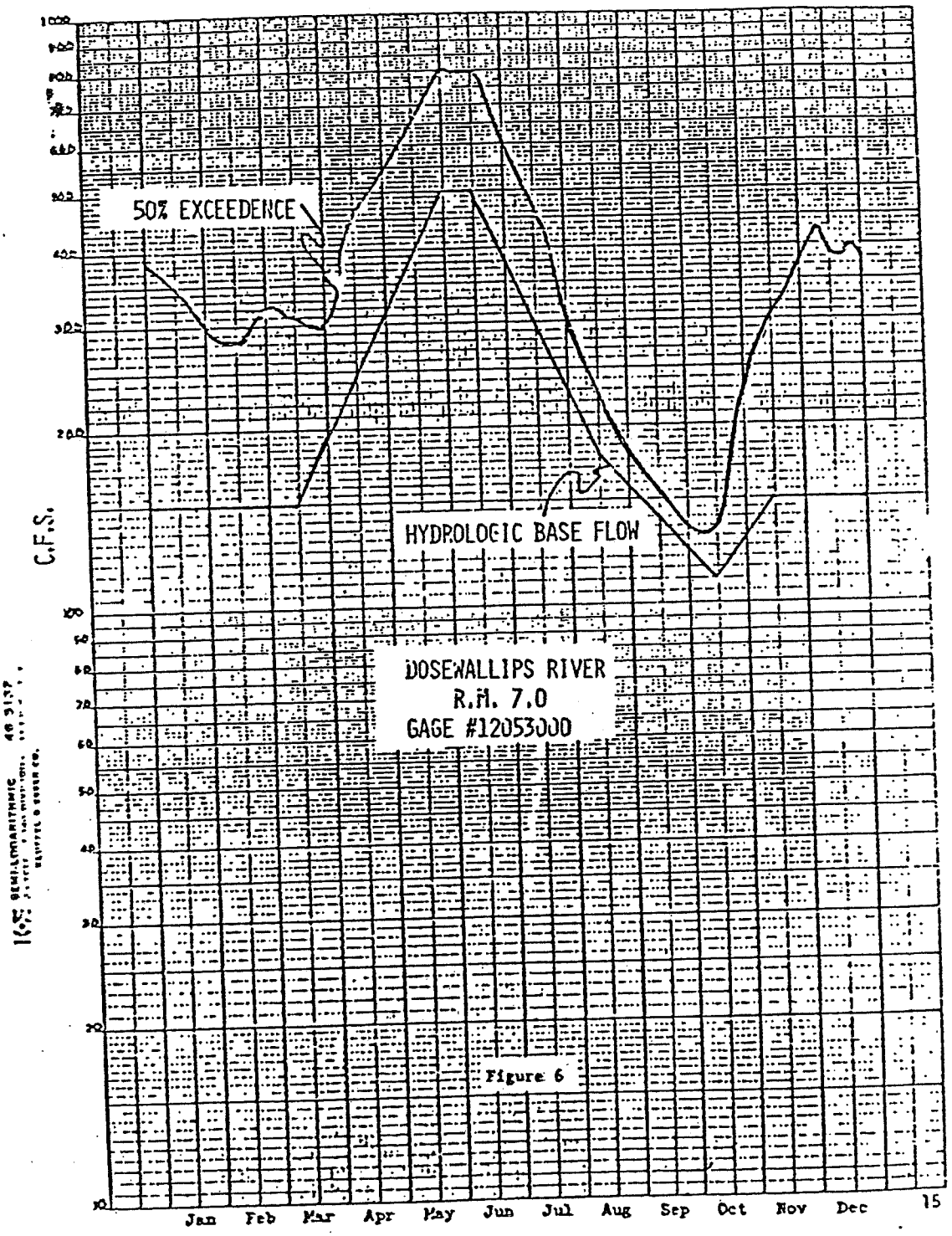
14

Figure 5


50% EXCEEDENCE
HYDROLOGIC BASE FLOW
DOSEWALLIPS RIVER
R.M. 7.0
GAGE #12053000
C.F.S.
1000
500
400
300
200
100
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40
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Jan
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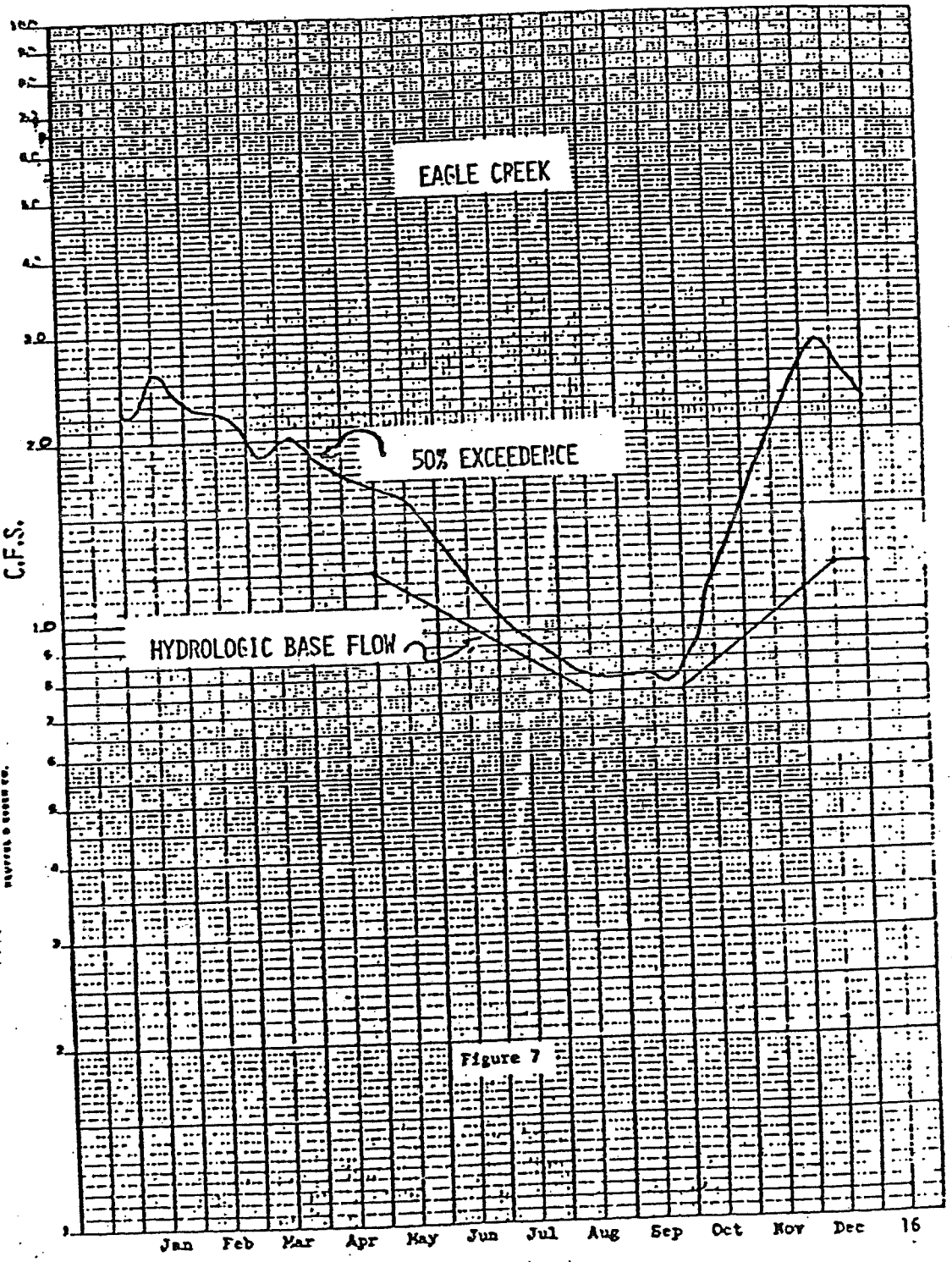
Figure 6


EAGLE CREEK
50% EXCEEDENCE
HYDROLOGIC BASE FLOW
C.F.S.
Jan
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16

Figure 7

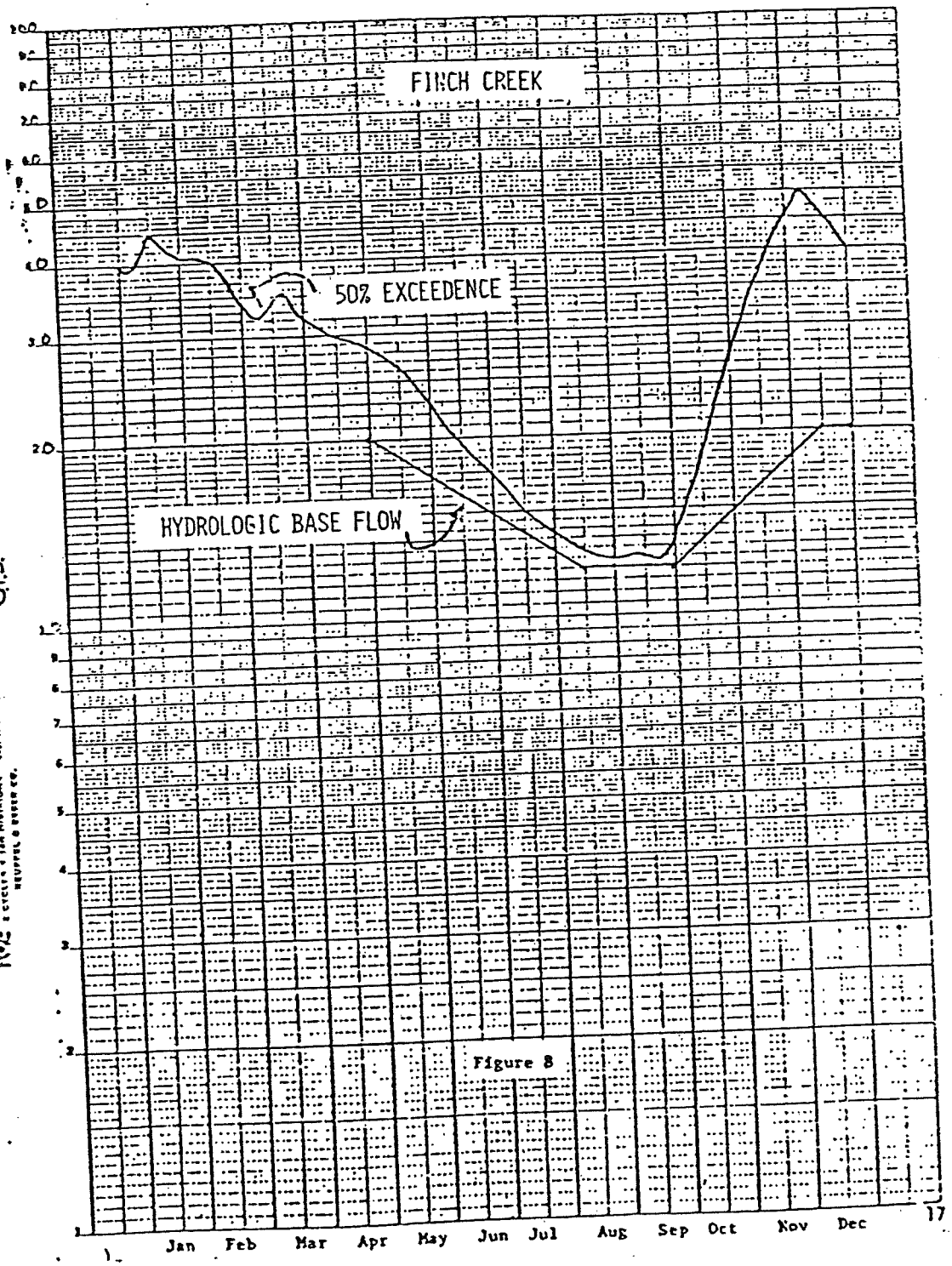
FINCH CREEK
50% EXCEEDENCE
HYDROLOGIC BASE FLOW
C.F.S.
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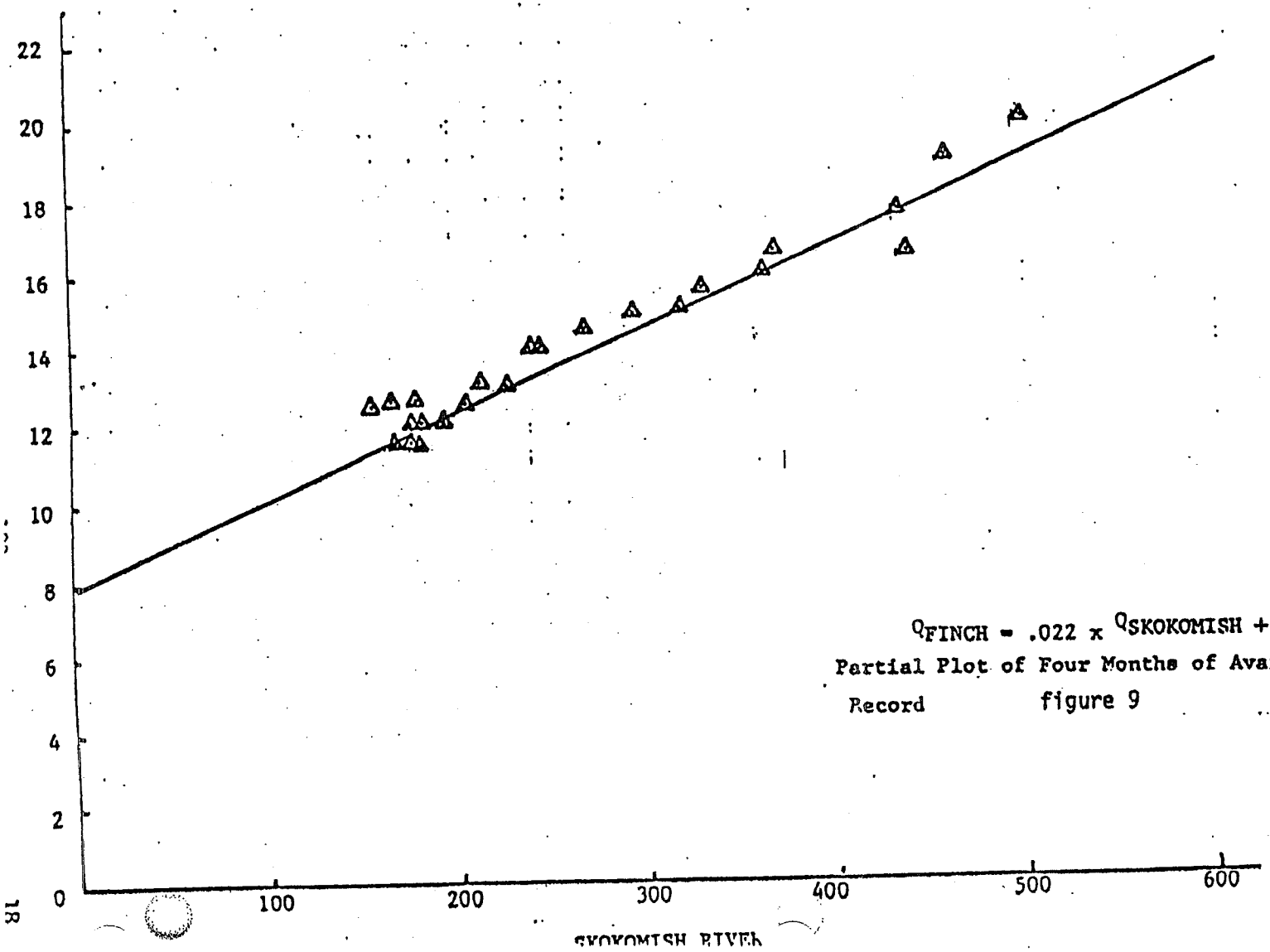
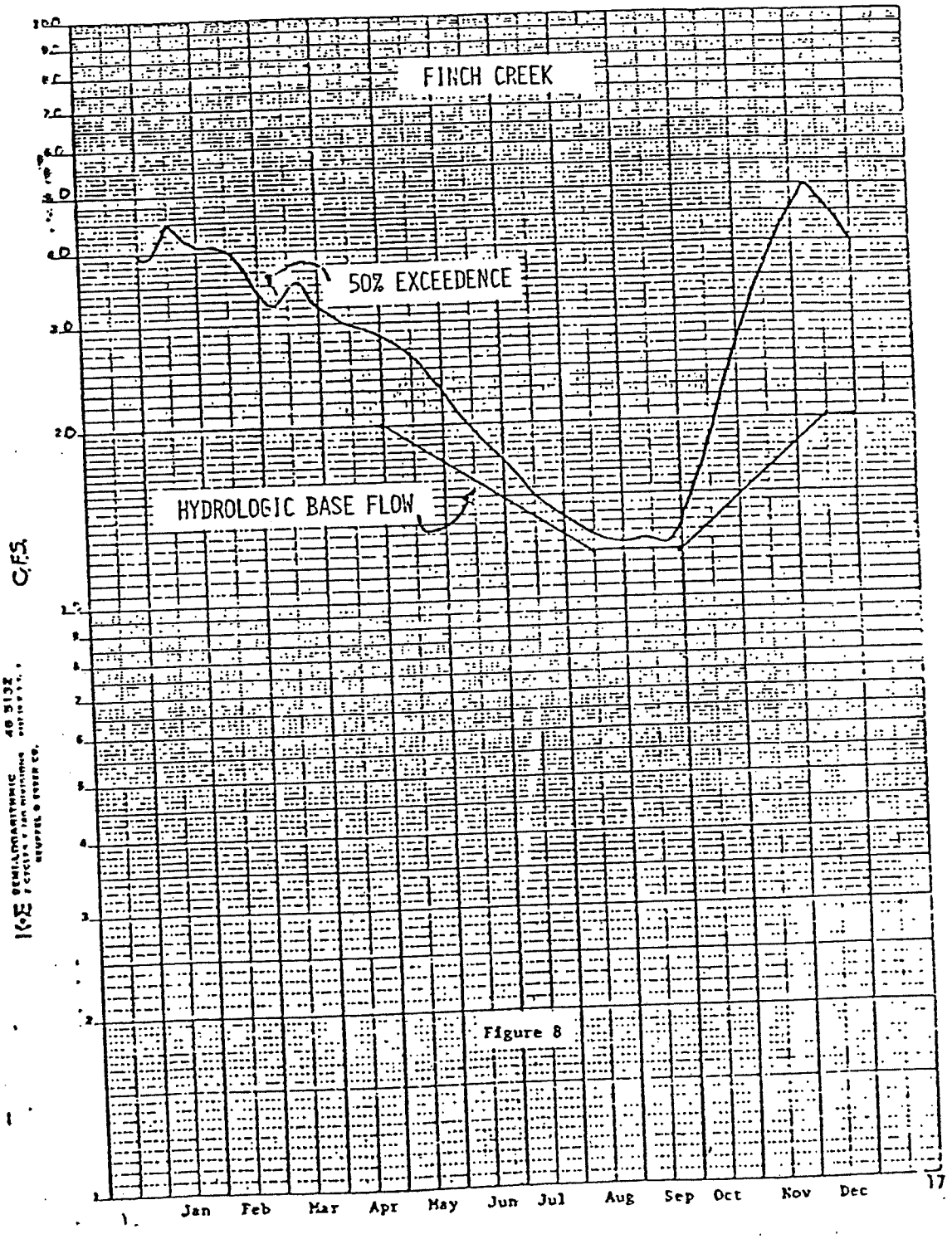
Figure 8



$Q_{FINCH} = .022 \times Q_{SKOKOMISH} + 7.96$ cfs

Partial Plot of Four Months of Available Record

figure 9


FINCH CREEK
50% EXCEEDENCE
HYDROLOGIC BASE FLOW
C.F.S.
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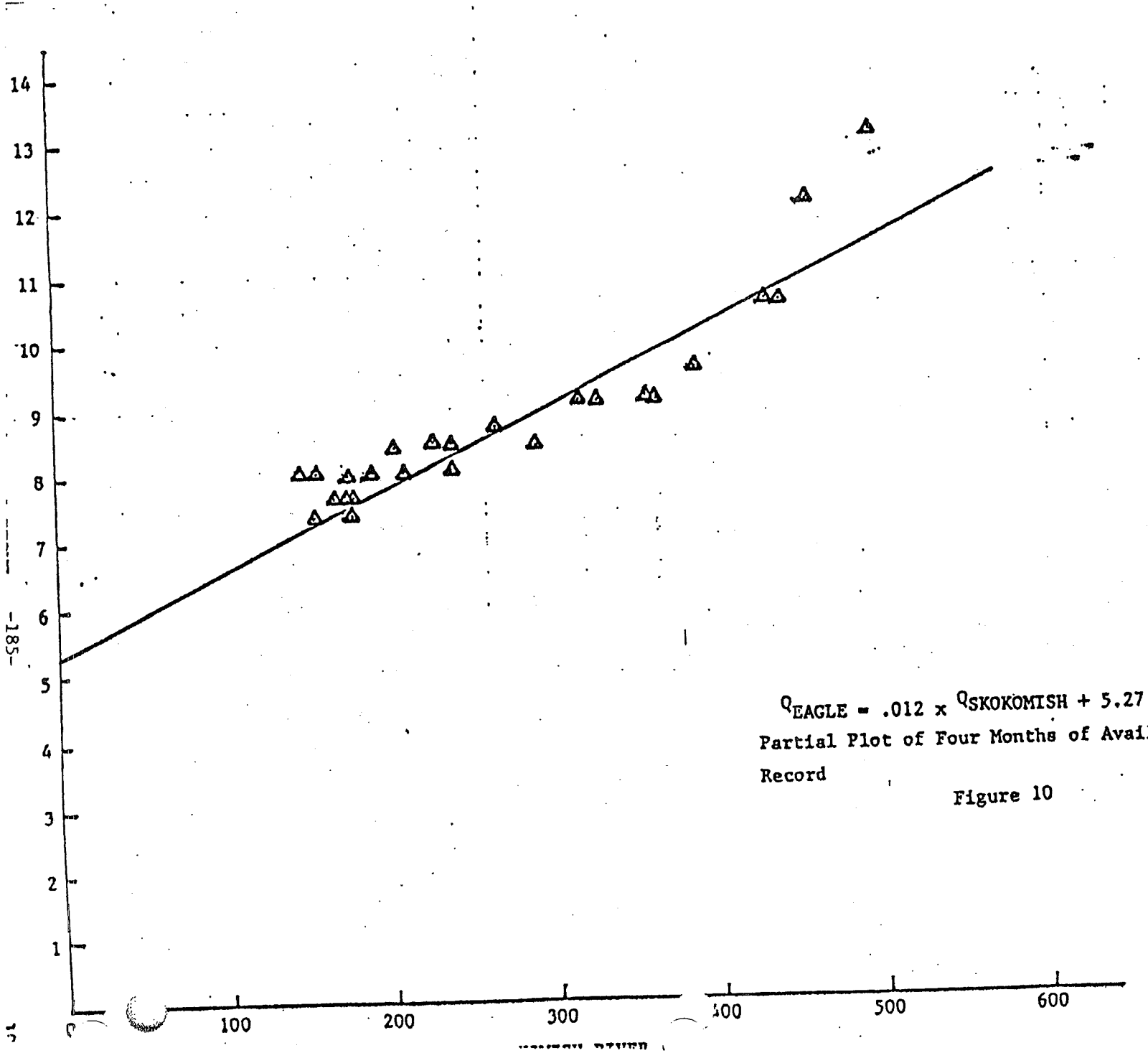
Nov
Dec

Figure 8



$Q_{EAGLE} = .012 \times Q_{SKOKOMISH} + 5.27$ cfs

Partial Plot of Four Months of Available Record

Figure 10

G.K.

Skokomish-Dosewallips Basin

WRIA 16

Technical Document Supplement

(Natural Flow Study)

Office Report No. 74-A

3 RD DRAFT 2/2/83

By

Ray Newkirk, P.E.

January 1983

State of Washington

Department of Ecology

Water Resources Management Division

Olympia, Washington 98504

Table of Contents

List of Tables

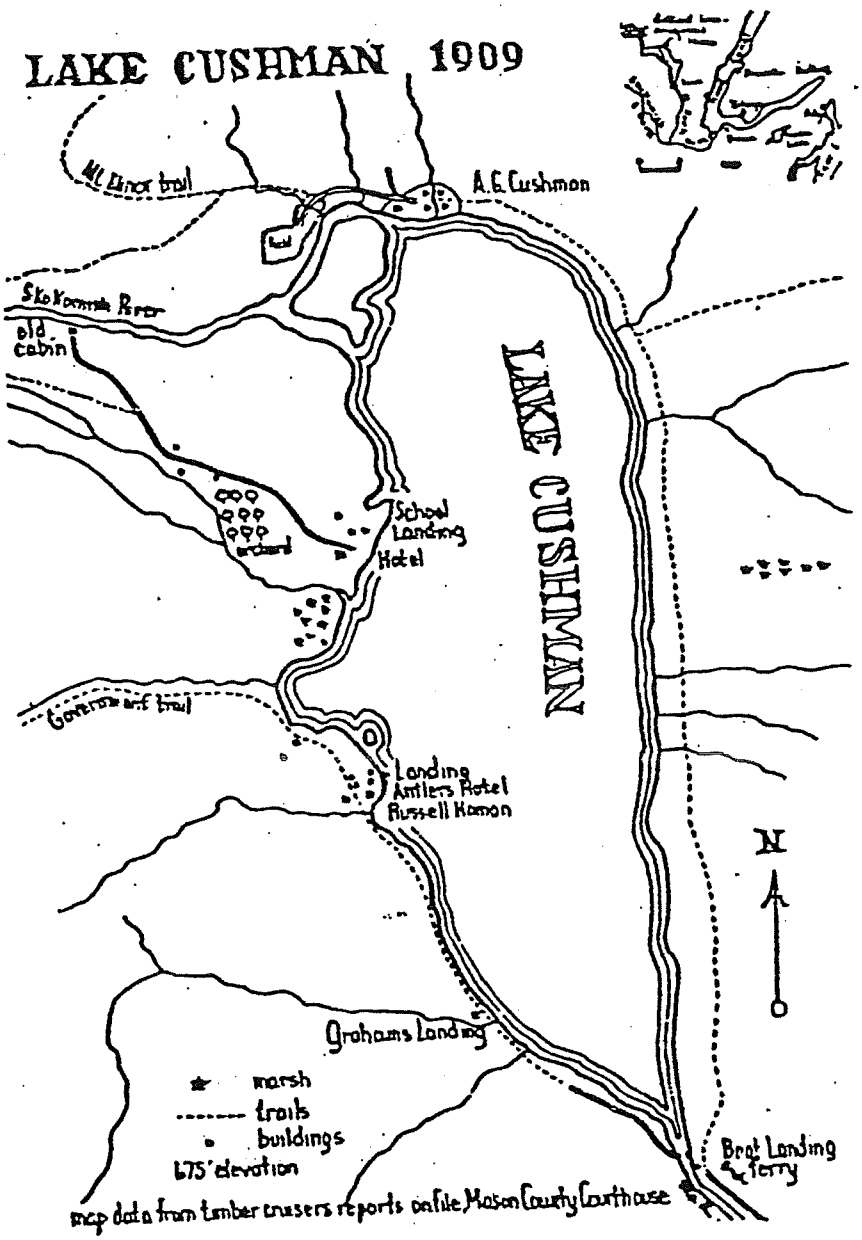
List of Figures

Page

I. Introduction

Cushman Lake No. 1 dam and power plant went into operation in 1926. Streamflow in the North Fork Skokomish River has been altered since. The North Fork Skokomish River became virtually dewatered during low flow periods since Cushman No. 2 power plant and dam went into operation in 1930. Tailwater from the Cushman Lake No. 2 power plant discharges into the Hood Canal directly and bypasses the main stem Skokomish River. Figure 1 shows a map of Lake Cushman as it was in 1909 (this area is inundated by the present Cushman Lake No. 1).

The purpose of this study of natural flows in the Skokomish River basin is to: (1) deregulate the North Fork Skokomish River and Skokomish River flows with respect to the City of Tacoma's Cushman Lake No. 1 and Cushman Lake No. 2 power operations (diversions) and (2) determine hydrologic base flows under natural conditions. This study supplements the Skokomish-Dosewallips Basin (WRIA 16) Technical Document, Office Report No. 74, dated April 1980. Figure 2 is a line diagram of the Skokomish River basin showing streams flowing into the forks and main stem of the Skokomish River, USGS gaging stations on the streams, and the lakes. The river mile locations for each are shown also. Figure 11 depicts a bar graph of all the USGS gaging stations in the Skokomish-Dosewallips with the period of record for each.



LENGTH: 1.5 MILES
AVERAGE WIDTH: 0.4 MILES
SURFACE AREA: 360 ACRES

FIGURE 1

MAP OF LAKE CUSHMAN 1909

II. Methodology

The City of Tacoma's power plant report of mean monthly natural flows at Cushman Lake No. 2 for the period 1943 through 1978 was used for this study (shown in Tables 3-14 and repeated in Tables 16-27).

Natural flows for the North Fork Skokomish River near Potlatch (Gage No. 12-0595-00) were determined by adding the gaged flow to the Cushman Lake No. 2 natural flow and adjusting for evaporation at Cushman Lake No. 1 and No. 2 (Tables 2-14). A Log-Pearson Type III distribution was calculated using the total natural flow columns in Tables 3-14. This statistical analysis resulted in the mean monthly flows for the specified percentage shown in Table 15. The Table 15 values were used to plot the 1%, 50%, and 99% probability curves for a duration hydrograph showing natural flows (Figure 7).

The natural flow duration hydrograph (Figure 4) for the Skokomish River near Potlatch (gage #12-0615-00) was determined by adjusting the gaged flow duration hydrograph (Figure 3) at the same location for the percentage increase (Tables 28 & 29) of the Cushman Lake No. 2 natural average monthly flow. The breakdown of natural flow at gage #12-0615-00 by month and year is shown in Tables 16-27.

Conversion factors used for this report are depicted in Table 30.

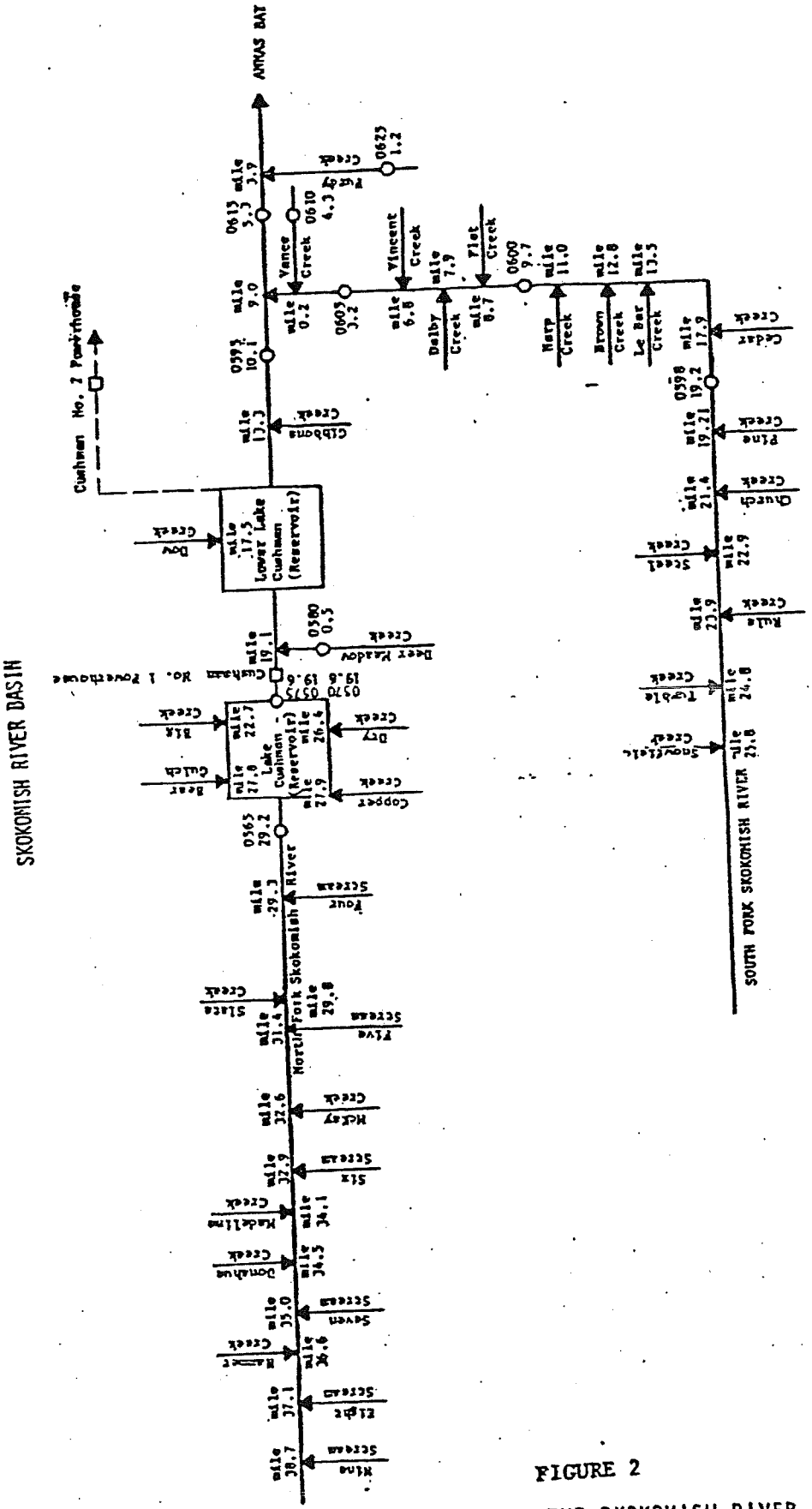


FIGURE 2

LINE DIAGRAM OF THE SKOKOMISH RIVER BASIN

III. Stream Management Reach Information

A. Skokomish River

The main stem Skokomish River originates at the confluence of the South Fork Skokomish River with the North Fork Skokomish River at River Mile 9.0. The river flows east to the Hood Canal between the towns of Potlatch and Union, WA. The drainage area is 227 square miles at Gage Number 12-0615-00 (including 99 square miles above Cushman Lake No. 2) with an average discharge of 1,208 cfs. The maximum instantaneous discharge of record is 27,000 cfs on November 3, 1955 and the minimum instantaneous discharge of record is 125 cfs on September 14-17, 1944. The period of record is July 1943 to the present.

B. North Fork Skokomish River

The North Fork Skokomish River originates in the Olympic National Park at approximately River Mile 39.0 and flows southeasterly to its confluence with the South Fork Skokomish River at River Mile 9.0. Streamflow from the North Fork is diverted at the Cushman Lake No. 2 dam for power generation. The drainage area is 117 square miles at Gage No. 12-0595-00 (including 99 square miles above Cushman Lake No. 2 dam) with an average discharge of 115 cfs. The maximum instantaneous discharge of record is 7,740 cfs on November 4, 1955. The minimum instantaneous discharge of record is 1.3 cfs on September 5, 14, and 16, 1951. The period of record is March 1944 to November 1949 and March 1950 to the present.

C. South Fork Skokomish River

The South Fork Skokomish River originates in the Olympic National Park and flows southeasterly approximately 27 river miles to its confluence with the North Fork Skokomish River. The drainage area is 76.3 square miles at Gage No. 12-0605-00 with an average discharge of 732 cfs. The maximum instantaneous discharge of record is 21,600 cfs on January 22, 1935. The minimum instantaneous discharge of record is 62 cfs on September 18, 1938. The period of record is August 1931 to the present.

D. List of Proposed Control Stations (WDOE)

Control Location Gage Number River Mile	Stream Management Reach
Skokomish River 12-0615-00 5.3	From influence of mean annual high tide at low instream flow levels to the confluence of the North Fork Skokomish River and South Fork Skokomish River except Purdy Creek.
North Fork Skokomish River 12-0595-00 10.1	From the confluence of the North and South Fork Skokomish River to the Lake Cushman No. 2 dam.
South Fork Skokomish River 12-0605-00 3.2	From the confluence of the North and South Fork Skokomish River to the headwaters.

IV. Hydrologic Base Flow Analysis

The hydrologic base flows for this study have been determined in accordance with WRIS Technical Bulletin No. 11 dated January 1976. The stream rating used is 69 percent which is the value for the Skokomish River (refer to Table 2 in the original Technical Document). The hydrologic base flows are depicted in tabular form in Table 1 and shown graphically in Figures 3-10.

V. Hydrographs

A. Skokomish River

The three hydrographs for Gage No. 12-0615-00 (Figures 3-5) show: 1) the gaged (regulated) flows with the hydrologic base flow, 2) the natural flows with the natural hydrologic base flow, and 3) the gaged (regulated) flows with the gage (regulated) hydrologic base flow and the natural hydrologic base flow.

B. North Fork Skokomish River

The three hydrographs for Gage No. 12-0595-00 (Figures 6-8) show the same items as outlined for the gage on the Skokomish River. Also, a hydrograph is included for Gage No. 12-0565-00 (Figure 9) showing gaged flows (the gage is above the Cushman reservoirs and the hydrograph is informational only).

C. South Fork Skokomish River

The hydrograph for Gage No. 12-0605-00 (Figure 10) shows the gaged flows and hydrologic base flow.

VI. Summary

This study shows that, if WDOE were to regulate the North Fork Skokomish River and the Skokomish River based on natural flows, these rivers would probably be closed for a minimum period of five months (May through September) to further surface water appropriations. In the case of the North Fork Skokomish River the closure could very easily run throughout the year as the Natural Hydrologic Base Flow exceeds the gaged one percent occurrence curve 3½ months of the year (Figure 8). The Natural Hydrologic Base Flow for the Skokomish River exceeds the 50 percent occurrence curve five months of the year (Figure 5).

~~As one would expect~~, the South Fork Skokomish River could only be affected by the City of Tacoma's North Fork diversion if its flows were expected to augment the main stem flows to meet instream flow requirements.

VII. Bibliography

References Cited

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Linsley, R. K. and Franzini, J. B., 1972. Second Edition Water-Resources Engineering, McGraw-Hill Book Co., Inc.

E. M. 2734, January 1968, Washington climate for these counties: King, Kitsap, Mason, Pierce, Cooperative Extension Service, College of Agriculture, Washington State University, Pullman.

Table 1. Hydrologic Base Flows

tream	Gage Number River Mile Sec. Twp Rge	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
		1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15	1	15
omish r ed)	12-0615-00 5.3 4, 23 N, 5W	560	560	560	560	560	560	560	560	560	560	465	385	320	260	220	180	180	180	180	225	280	350	460	560
omish r ural)	12-0615-00 5.3 4, 23 N, 5W	950	950	950	950	950	950	950	950	950	950	950	780	630	510	410	330	330	330	330	410	500	620	760	950
h Fork omish r ed)	12-0595-00 10.1 7, 21 N, 4W	50	50	50	50	50	50	50	42	36	30	25	20	16	12.5	10	8	8	8	8	10.5	15	20	27	36
h Fork omish r ural)	12-0595-00 10-1 7, 21 N, 4W	640	620	610	590	580	560	550	540	520	510	500	420	345	290	235	195	160	160	210	275	370	480	640	640
h Fork omish r ed)	12-0605-00 3.2 2, 21 N, 5W	350	350	350	350	350	350	350	350	350	310	265	230	200	160	125	100	100	100	100	125	165	210	270	350

AV/W48(A2-4)

Table 2. Monthly Evaporation from the Cushman Reservoirs

(1) Month	(2) * Class A Pan Evaporation (inches of water)	(3) ** Reservoir Evaporation (inches of water)	(4) *** Avg. Evaporation for Cushman No. 1 (Surface area = 3500 acres) acre-ft	cfs	(5) Max. Evaporation for Cushman No. 2 (Surface area = 150 acres) acre-ft	cfs	(6) Max. Evaporation for Original Lake Cushman (Surface area = 360 acres acre-ft	cfs	(7) Total Evaporation for Natural Flow Calculation (cfs)
JAN	0.57	0.41	119.67	2.0	5.13	0.1	12.30	0.2	1.9
FEB	0.88	0.63	183.75	3.3	7.88	0.1	18.90	0.3	3.1
MAR	1.74	1.25	364.58	5.9	15.63	0.3	37.50	0.6	5.6
APR	3.14	2.26	659.17	11.1	28.25	0.5	67.80	1.1	10.5
MAY	4.64	3.34	974.17	15.9	41.75	0.7	100.20	1.6	15.0
JUN	5.05	3.64	1061.67	17.9	45.50	0.8	109.20	1.8	16.9
JUL	6.67	4.80	1400.00	22.8	60.00	1.0	144.00	2.3	21.5
AUG	5.28	3.80	1108.33	18.0	47.50	0.8	114.00	1.9	16.9
SEP	3.48	2.51	732.08	12.3	31.38	0.5	75.30	1.3	11.5
OCT	1.65	1.19	347.08	5.7	14.88	0.2	35.70	0.6	5.3
NOV	0.70	0.50	145.83	2.5	6.25	0.1	15.00	0.3	2.3
DEC	0.52	0.37	107.92	1.8	4.63	0.1	11.10	0.2	1.7
TOTAL	34.32	24.71	7204.25		308.78		741.30		

AV/W48(A5-6)

* Average for Seattle Maple Leaf Reservoir (from E.M. 2734 January, 1968, "Washington Climate for these Counties: King, Kitsap, Mason, and Pierce").
** Assumed 72% of Class A pan evaporation (page 31, Second Edition Water Resources Engineering by Linsley & Franzini).
*** Based on approximate operating range of the lake (max. elev. 738 = 4010 acres, min. elev. 685 = 3100 acres) (avg. elev. 710 = 3500 acres)

Calculations:

(3) = 0.72 (2)
(4),(5), & (6) = (3) surface area = acre-ft = cfs
(7) = (4) + (5) - (6)

Table 3
Natural Flows at Gage No. 12-0595-00
for January

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1945	180.1	1077	1.9	1259
1946	199.3	1100	1.9	1301
1947	127.1	747	1.9	876
1948	157.2	870	1.9	1029
1949	53.6	244	1.9	300
1950	--	--	--	-
1951	732.5	1088	1.9	1822
1952	158.3	672	1.9	832
1953	696.9	3084	1.9	3783
1954	278.9	1082	1.9	1363
1955	121.8	570	1.9	694
1956	256.9	1144	1.9	1403
1957	68.9	374	1.9	445
1958	224.5	1796	1.9	2022
1959	508.9	1828	1.9	2339
1960	192.5	1192	1.9	1386
1961	466.4	2242	1.9	2710
1962	106.0	973	1.9	1081
1963	205.4	724	1.9	931
1964	292.3	1413	1.9	1707
1965	143.1	861	1.9	1006
1966	285.7	1243	1.9	1531
1967	284.0	1551	1.9	1837
1968	301.9	2203	1.9	2507
1969	121.4	696	1.9	819
1970	219.6	1331	1.9	1553
1971	234.4	1247	1.9	1483
1972	206.6	1011	1.9	1220
1973	190.8	1254	1.9	1447
1974	937.7	2235	1.9	3175
1975	171.7	958	1.9	1132
1976	215.5	1278	1.9	1495
1977	47.6	448	1.9	498
1978	167.1	1302	1.9	1471

Table 4
Natural Flows at Gage No. 12-0595-00
for February

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1945	222.2	1482	3.1	1707
1946	169.4	879	3.1	1051
1947	187.4	1852	3.1	2042
1948	134.2	702	3.1	839
1949	254.5	924	3.1	1181
1950	--	--	--	--
1951	982.2	1773	3.1	2758
1952	231.9	1018	3.1	1253
1953	399.5	1054	3.1	1456
1954	496.0	1891	3.1	2390
1955	121.0	711	3.1	835
1956	89.0	363	3.1	455
1957	184.7	1390	3.1	1578
1958	507.6	2218	3.1	2728
1959	106.5	613	3.1	722
1960	225.8	1388	3.1	1616
1961	502.0	2207	3.1	2712
1962	73.6	866	3.1	942
1963	142.1	1638	3.1	1783
1964	120.7	642	3.1	766
1965	208.8	1136	3.1	1348
1966	131.9	762	3.1	897
1967	146.8	806	3.1	956
1968	269.0	1930	3.1	2202
1969	125.4	614	3.1	742
1970	151.8	871	3.1	1026
1971	134.6	1169	3.1	1306
1972	195.3	1398	3.1	1596
1973	76.6	641	3.1	720
1974	190.7	874	3.1	1068
1975	152.8	651	3.1	807
1976	140.6	831	3.1	974
1977	65.8	666	3.1	735
1978	131.8	1088	3.1	1223

Table 5
Natural Flows at Gage No. 12-0595-00
for March

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1945	190.6	745	5.6	941
1946	150.3	780	5.6	936
1947	56.2	582	5.6	644
1948	98.2	480	5.6	584
1949	164.4	1103	5.6	1273
1950	--	--	--	--
1951	161.6	501	5.6	668
1952	78.8	519	5.6	603
1953	85.7	545	5.6	636
1954	105.8	812	5.6	923
1955	83.7	394	5.6	483
1956	227.2	775	5.6	1008
1957	140.4	1130	5.6	1276
1958	85.3	730	5.6	821
1959	83.0	667	5.6	756
1960	116.9	812	5.6	934
1961	570.2	1400	5.6	1976
1962	106.7	516	5.6	628
1963	74.5	632	5.6	712
1964	112.3	589	5.6	707
1965	75.3	563	5.6	644
1966	185.5	1039	5.6	1230
1967	158.0	1044	5.6	1208
1968	174.6	1306	5.6	1486
1969	157.3	775	5.6	938
1970	105.3	886	5.6	997
1971	264.7	1038	5.6	1308
1972	247.9	2081	5.6	2334
1973	85.4	727	5.6	818
1974	238.8	1500	5.6	1744
1975	136.9	847	5.6	990
1976	135.4	609	5.6	750
1977	154.3	666	5.6	826
1978	84.1	884	5.6	974

AV/W48(A7-9)

Table 6
Natural Flows at Gage No. 12-0595-00
for April

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	59.5	511	10.5	581
1945	66.1	489	10.5	566
1946	145.0	999	10.5	1154
1947	41.4	532	10.5	584
1948	85.7	730	10.5	826
1949	58.6	871	10.5	940
1950	108.2	816	10.5	935
1951	44.7	818	10.5	873
1952	47.9	937	10.5	995
1953	48.8	635	10.5	694
1954	83.3	781	10.5	875
1955	146.7	739	10.5	896
1956	88.2	1050	10.5	1149
1957	75.2	901	10.5	987
1958	102.9	824	10.5	937
1959	240.3	1050	10.5	1301
1960	148.2	1044	10.5	1203
1961	58.5	778	10.5	847
1962	60.7	729	10.5	800
1963	124.2	856	10.5	991
1964	40.4	525	10.5	576
1965	74.7	881	10.5	966
1966	48.6	895	10.5	954
1967	68.1	475	10.5	554
1968	73.2	365	10.5	449
1969	123.4	1076	10.5	1210
1970	108.1	832	10.5	951
1971	142.4	832	10.5	985
1972	114.8	1080	10.5	1205
1973	32.7	476	10.5	519
1974	121.8	906	10.5	1038
1975	56.2	447	10.5	514
1976	70.2	640	10.5	721
1977	37.2	675	10.5	723
1978	80.7	780	10.5	871

Table 7
Natural Flows at Gage No. 12-0595-00
for May

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	30.5	509	15.0	554
1945	55.7	1243	15.0	1314
1946	145.0	1160	15.0	1320
1947	22.2	462	15.0	499
1948	139.4	1439	15.0	1593
1949	45.1	1249	15.0	1309
1950	38.3	894	15.0	947
1951	25.9	804	15.0	845
1952	28.1	1157	15.0	1200
1953	37.5	1007	15.0	1397
1954	24.0	788	15.0	827
1955	43.7	690	15.0	749
1956	31.9	1540	15.0	1587
1957	37.0	871	15.0	923
1958	41.5	883	15.0	940
1959	136.5	850	15.0	1002
1960	59.5	875	15.0	950
1961	49.2	1068	15.0	1132
1962	69.4	710	15.0	794
1963	130.9	796	15.0	942
1964	22.2	604	15.0	641
1965	48.8	712	15.0	776
1966	24.8	936	15.0	976
1967	32.2	877	15.0	924
1968	33.3	811	15.0	859
1969	43.3	1468	15.0	1526
1970	36.6	508	15.0	560
1971	42.0	1514	15.0	1571
1972	40.7	1003	15.0	1059
1973	24.6	687	15.0	727
1974	60.9	1024	15.0	1100
1975	48.8	908	15.0	972
1976	35.6	845	15.0	896
1977	22.9	601	15.0	639
1978	66.6	758	15.0	840

Table 8
Natural Flows at Gage No. 12-0595-00
for June

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	20.6	377	16.9	414
1945	24.3	555	16.9	596
1946	319.5	993	16.9	1329
1947	16.2	397	16.9	430
1948	28.9	1117	16.9	1163
1949	24.3	695	16.9	736
1950	18.2	1222	16.9	1257
1951	10.1	595	16.9	622
1952	13.6	784	16.9	814
1953	21.2	694	16.9	732
1954	14.7	709	16.9	741
1955	23.1	963	16.9	1003
1956	39.0	1561	16.9	1617
1957	23.3	433	16.9	473
1958	21.0	556	16.9	594
1959	32.9	758	16.9	808
1960	29.7	757	16.9	804
1961	21.8	886	16.9	925
1962	26.1	627	16.9	670
1963	23.2	408	16.9	448
1964	17.2	1090	16.9	1124
1965	22.6	549	16.9	589
1966	16.5	725	16.9	758
1967	17.8	1090	16.9	1125
1968	30.5	780	16.9	827
1969	300.2	1181	16.9	1498
1970	17.9	548	16.9	583
1971	103.3	1092	16.9	1212
1972	21.4	801	16.9	839
1973	21.2	679	16.9	717
1974	34.8	1320	16.9	1372
1975	21.2	1072	16.9	1110
1976	23.4	836	16.9	876
1977	21.3	569	16.9	607
1978	34.8	623	16.9	675

AV/W48(A10-12)

Table 9
Natural Flows at Gage No. 12-0595-00
for July

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	9.2	151	21.5	182
1945	12.3	256	21.5	290
1946	214.9	655	21.5	891
1947	12.2	211	21.5	245
1948	13.3	382	21.5	417
1949	8.5	388	21.5	418
1950	9.9	697	21.5	728
1951	5.3	257	21.5	284
1952	7.6	495	21.5	524
1953	10.1	596	21.5	628
1954	22.2	712	21.5	756
1955	26.2	595	21.5	643
1956	18.9	970	21.5	1010
1957	16.8	279	21.5	317
1958	14.3	205	21.5	241
1959	18.7	369	21.5	409
1960	17.6	351	21.5	390
1961	11.9	365	21.5	398
1962	15.3	326	21.5	363
1963	23.6	332	21.5	377
1964	13.0	619	21.5	654
1965	12.9	258	21.5	292
1966	11.7	461	21.5	494
1967	11.2	497	21.5	530
1968	15.7	389	21.5	426
1969	15.7	375	21.5	412
1970	12.7	226	21.5	260
1971	102.4	968	21.5	1352
1972	36.3	620	21.5	678
1973	14.9	275	21.5	311
1974	22.2	998	21.5	1042
1975	14.2	541	21.5	577
1976	15.7	600	21.5	637
1977	10.2	163	21.5	195

Table 10
Natural Flows at Gage No. 12-0595-00
for August

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	7.8	97	16.9	122
1945	8.0	61	16.9	86
1946	14.0	225	16.9	256
1947	7.2	96	16.9	120
1948	12.0	189	16.9	218
1949	7.3	168	16.9	192
1950	7.6	326	16.9	350
1951	2.8	108	16.9	128
1952	11.9	262	16.9	291
1953	6.2	242	16.9	265
1954	8.9	318	16.9	344
1955	10.9	256	16.9	284
1956	14.8	342	16.9	374
1957	10.2	190	16.9	217
1958	6.4	96	16.9	119
1959	9.3	137	16.9	163
1960	13.8	165	16.9	196
1961	9.7	164	16.9	191
1962	12.7	224	16.9	254
1963	9.4	163	16.9	189
1964	11.6	310	16.9	338
1965	10.0	142	16.9	169
1966	8.3	200	16.9	225
1967	8.5	199	16.9	224
1968	15.3	244	16.9	276
1969	13.5	154	16.9	184
1970	8.7	111	16.9	137
1971	12.4	452	16.9	481
1972	130.3	205	16.9	352
1973	12.1	193	16.9	222
1974	15.9	397	16.9	430
1975	14.6	418	16.9	450
1976	12.3	263	16.9	292
1977	9.8	177	16.9	204

Table 11
Natural Flows at Gage No. 12-0595-00
for September

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	4.5	128	11.5	144
1945	9.1	173	11.5	194
1946	10.8	150	11.5	172
1947	9.5	78	11.5	99
1948	19.2	405	11.5	436
1949	8.9	167	11.5	187
1950	8.4	152	11.5	172
1951	5.0	207	11.5	224
1952	4.9	124	11.5	140
1953	6.1	280	11.5	298
1954	7.3	200	11.5	219
1955	10.2	191	11.5	213
1956	11.9	257	11.5	280
1957	6.1	128	11.5	146
1958	7.6	114	11.5	133
1959	22.4	513	11.5	547
1960	10.6	127	11.5	149
1961	10.8	132	11.5	154
1962	13.5	268	11.5	293
1963	8.4	112	11.5	132
1964	10.0	176	11.5	198
1965	7.9	100	11.5	119
1966	8.4	59	11.5	79
1967	9.8	143	11.5	164
1968	18.1	314	11.5	344
1969	30.4	609	11.5	651
1970	12.8	32	11.5	56
1971	15.3	342	11.5	369
1972	16.3	393	11.5	421
1973	11.1	153	11.5	176
1974	12.3	222	11.5	246
1975	8.1	206	11.5	226
1976	8.2	170	11.5	190
1977	16.8	399	11.5	427

AV/W48(A13-15)

Table 12
Natural Flows at Gage No. 12-0595-00
for October

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1945	5.4	257	5.3	268
1946	10.3	238	5.3	254
1947	18.8	293	5.3	317
1948	356.3	1408	5.3	1770
1949	35.5	497	5.3	538
1950	--	--	--	--
1951	234.0	1161	5.3	1400
1952	942.7	943	5.3	1891
1953	5.4	98	5.3	109
1954	25.9	591	5.3	622
1955	29.1	720	5.3	754
1956	87.1	841	5.3	933
1957	82.8	963	5.3	1051
1958	22.2	453	5.3	480
1959	15.7	440	5.3	461
1960	41.7	471	5.3	518
1961	25.8	518	5.3	549
1962	22.7	380	5.3	408
1963	69.4	981	5.3	1056
1964	79.4	1006	5.3	1091
1965	13.1	273	5.3	291
1966	16.4	353	5.3	375
1967	16.7	387	5.3	409
1968	125.7	1697	5.3	1828
1969	52.9	735	5.3	793
1970	54.5	457	5.3	517
1971	32.3	664	5.3	702
1972	24.9	386	5.3	416
1973	14.9	77	5.3	97
1974	29.4	525	5.3	560
1975	7.8	115	5.3	128
1976	305.8	1744	5.3	2055
1977	8.7	178	5.3	192
1978	31.3	598	5.3	635

Table 13
Natural Flows at Gage No. 12-0595-00
for November

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1945	96.7	1396	2.3	1495
1946	154.3	1127	2.3	1284
1947	57.1	812	2.3	871
1948	167.0	608	2.3	777
1949	134.1	968	2.3	1104
1950	--	--	--	--
1951	305.7	1468	2.3	1776
1952	132.8	1036	2.3	1171
1953	12.9	315	2.3	330
1954	141.4	1577	2.3	1721
1955	852.4	2476	2.3	3331
1956	935.6	1789	2.3	2727
1957	77.2	645	2.3	724
1958	60.4	582	2.3	645
1959	108.6	1164	2.3	1275
1960	256.4	1150	2.3	1409
1961	175.6	1048	2.3	1226
1962	80.7	911	2.3	994
1963	298.0	1601	2.3	1901
1964	253.1	1814	2.3	2069
1965	99.3	753	2.3	855
1966	83.9	1163	2.3	1249
1967	71.6	1246	2.3	1320
1968	113.2	898	2.3	1014
1969	132.2	1058	2.3	1192
1970	67.0	804	2.3	873
1971	128.1	1229	2.3	1359
1972	129.8	1287	2.3	1419
1973	84.1	1095	2.3	1181
1974	234.5	1429	2.3	1666
1975	88.2	1036	2.3	1126
1976	1005.2	2002	2.3	3010
1977	12.6	302	2.3	317
1978	206.6	1623	2.3	1832

Table 14
Natural Flows at Gage No. 12-0595-00
for December

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1945	80.6	669	1.7	751
1946	216.9	1460	1.7	1679
1947	133.5	1521	1.7	1656
1948	125.7	1227	1.7	1354
1949	85.7	688	1.7	775
1950	--	--	--	--
1951	1262.2	2292	1.7	3556
1952	421.8	690	1.7	1114
1953	185.5	1090	1.7	1277
1954	235.2	1418	1.7	1655
1955	228.6	1252	1.7	1482
1956	250.0	1189	1.7	1441
1957	188.6	1249	1.7	1439
1958	153.5	1217	1.7	1372
1959	173.6	1633	1.7	1808
1960	224.7	1208	1.7	1434
1961	155.0	1142	1.7	1299
1962	196.7	1144	1.7	1342
1963	344.1	1535	1.7	1881
1964	186.6	1264	1.7	1452
1965	150.4	908	1.7	1060
1966	146.0	1204	1.7	1352
1967	370.3	2909	1.7	3281
1968	270.1	1251	1.7	1523
1969	250.6	1478	1.7	1730
1970	181.0	1311	1.7	1494
1971	274.4	1175	1.7	1451
1972	157.7	713	1.7	872
1973	264.5	1737	1.7	2003
1974	352.1	2078	1.7	2432
1975	182.5	1556	1.7	1740
1976	744.1	1929	1.7	2675
1977	32.9	438	1.7	473
1978	251.4	1724	1.7	1977

Table 15
Log Pearson Type III Frequency Distribution
Natural Flows at Gage No. 12-0595-00, N.F. Skokomish River near Potlatch

Percent Occurrence	Mean Montly Flow (cfs)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
99	297	454	473	386	459	355	157	80	60	72	293	525
95	491	593	547	504	573	449	209	111	85	138	483	740
90	629	688	599	575	643	510	245	131	103	191	616	879
80	834	827	676	667	739	596	299	160	130	281	810	1073
50	1352	1198	889	859	959	805	446	230	203	561	1286	1525
20	2047	1772	1238	1066	1234	1092	681	323	320	1058	1893	2090
10	2478	2195	1508	1176	1404	1283	858	382	408	1442	2250	2429
1	3650	3738	2584	1433	1892	1893	1524	556	727	2843	3158	3344

AV/W48(B2)

Table 16
Natural Flows at Gage No. 12-0615-00
for January

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	1660.1	1098	1.9	2760
1945	1714.9	1077	1.9	2794
1946	2147.4	1100	1.9	3249
1947	1577.8	747	1.9	2327
1948	1903.0	870	1.9	2775
1949	523.6	244	1.9	770
1950	1909.8	870	1.9	2782
1951	2833.9	1088	1.9	3924
1952	1219.5	672	1.9	1893
1953	5540.3	3084	1.9	8626
1954	2255.8	1082	1.9	3340
1955	1190.2	570	1.9	1762
1956	2419.0	1144	1.9	3565
1957	729.1	374	1.9	1105
1958	2979.7	1796	1.9	4778
1959	3176.5	1828	1.9	5006
1960	1773.6	1192	1.9	2968
1961	3961.4	2242	1.9	6205
1962	1459.0	973	1.9	2434
1963	1457.5	724	1.9	2183
1964	2698.7	1413	1.9	4114
1965	1608.1	861	1.9	2471
1966	2600.6	1243	1.9	3846
1967	3010.7	1551	1.9	4564
1968	3303.9	2203	1.9	5509
1969	1344.6	696	1.9	2042
1970	2212.9	1331	1.9	3546
1971	2554.3	1247	1.9	3803
1972	2313.5	1011	1.9	3326
1973	2186.0	1254	1.9	3444
1974	3973.1	2235	1.9	6210
1975	1751.0	958	1.9	2711
1976	2177.7	1278	1.9	3458
1977	811.0	448	1.9	1261
1978	1829.4	1302	1.9	3133

Table 17
Natural Flows at Gage No. 12-0615-00
for February

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	1011.8	614	3.1	1629
1945	2316.0	1482	3.1	3801
1946	1775.6	879	3.1	2658
1947	3048.4	1852	3.1	4904
1948	1305.6	702	3.1	2011
1949	2111.7	924	3.1	3039
1950	2647.9	1273	3.1	3924
1951	4001.5	1773	3.1	5778
1952	2143.5	1018	3.1	3165
1953	2398.7	1054	3.1	3456
1954	3759.6	1891	3.1	5654
1955	1511.4	711	3.1	2226
1956	780.4	363	3.1	1146
1957	2167.1	1390	3.1	3560
1958	3372.9	2218	3.1	5594
1959	1125.8	613	3.1	1742
1960	2261.7	1388	3.1	3653
1961	4045.4	2207	3.1	6256
1962	1099.0	866	3.1	1968
1963	2036.7	1638	3.1	3678
1964	1358.5	642	3.1	2004
1965	2324.3	1136	3.1	3463
1966	1397.2	762	3.1	2162
1967	1877.8	806	3.1	2687
1968	3167.9	1930	3.1	5101
1969	1124.3	614	3.1	1741
1970	1474.2	871	3.1	2348
1971	1764.3	1169	3.1	2936
1972	2809.6	1398	3.1	4211
1973	1024.1	641	3.1	1668
1974	2158.9	874	3.1	3036
1975	1378.5	651	3.1	2033
1976	1512.6	831	3.1	2347
1977	1038.6	666	3.1	1708
1978	1512.9	1088	3.1	2604

Table 18
Natural Flows at Gage No. 12-0615-00
for March

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	789.0	448	5.6	1243
1945	1725.2	745	5.6	2476
1946	1721.6	780	5.6	2507
1947	772.4	582	5.6	1360
1948	1033.5	480	5.6	1519
1949	2151.3	1103	5.6	3260
1950	3241.0	1155	5.6	4402
1951	1076.5	501	5.6	1583
1952	1002.1	519	5.6	1527
1953	1041.4	545	5.6	1592
1954	1339.6	812	5.6	2157
1955	815.5	394	5.6	1215
1956	1957.9	775	5.6	2738
1957	1948.1	1130	5.6	3084
1958	1038.6	730	5.6	1774
1959	1181.5	667	5.6	1854
1960	1359.2	812	5.6	2177
1961	3024.8	1400	5.6	4430
1962	1016.4	516	5.6	1538
1963	970.9	632	5.6	1608
1964	1319.8	589	5.6	1914
1965	937.8	563	5.6	1506
1966	1913.7	1039	5.6	2958
1967	1865.7	1044	5.6	2915
1968	2150.7	1306	5.6	3462
1969	1666.0	775	5.6	2447
1970	1217.4	886	5.6	2109
1971	2143.0	1038	5.6	3187
1972	3431.9	2081	5.6	5518
1973	1154.8	727	5.6	1937
1974	2789.4	1500	5.6	4295
1975	1464.2	847	5.6	2317
1976	1322.2	609	5.6	1937
1977	1463.7	666	5.6	2135
1978	1075.8	884	5.6	1965

AV/W48(A19-21)

Table 19
Natural Flows at Gage No. 12-0615-00
for April

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	832.8	511	10.5	1354
1945	959.0	489	10.5	1458
1946	1666.2	999	10.5	2676
1947	642.7	532	10.5	1185
1948	1183.7	730	10.5	1924
1949	1181.4	871	10.5	2063
1950	1624.3	816	10.5	2451
1951	1019.4	818	10.5	1848
1952	1221.1	937	10.5	2169
1953	868.4	635	10.5	1514
1954	1237.2	781	10.5	2029
1955	1520.1	739	10.5	2270
1956	1762.3	1050	10.5	2823
1957	1201.3	901	10.5	2113
1958	1424.2	824	10.5	2259
1959	1976.3	1050	10.5	3037
1960	1659.0	1044	10.5	2714
1961	993.7	778	10.5	1782
1962	1043.7	729	10.5	1783
1963	1488.9	856	10.5	2355
1964	845.8	525	10.5	1381
1965	1226.1	881	10.5	2118
1966	1042.7	895	10.5	1948
1967	881.0	475	10.5	1366
1968	922.5	365	10.5	1298
1969	2005.0	1076	10.5	3092
1970	1413.1	832	10.5	2256
1971	1552.7	832	10.5	2395
1972	1634.7	1080	10.5	2725
1973	487.3	476	10.5	974
1974	1614.7	906	10.5	2531
1975	855.2	447	10.5	1313
1976	1130.4	640	10.5	1781
1977	734.5	675	10.5	1420
1978	976.5	780	10.5	1767

Table 20
Natural Flows at Gage No. 12-0615-00
for May

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	504.1	509	15.0	1028
1945	1124.5	1243	15.0	2382
1946	1220.6	1160	15.0	2396
1947	496.9	462	15.0	974
1948	1675.0	1439	15.0	3129
1949	1147.2	1249	15.0	2411
1950	1048.8	894	15.0	1958
1951	751.0	804	15.0	1570
1952	1039.9	1157	15.0	2212
1953	969.9	1007	15.0	1992
1954	674.5	788	15.0	1478
1955	812.5	690	15.0	1518
1956	1308.7	1540	15.0	2864
1957	641.8	871	15.0	1528
1958	683.1	883	15.0	1581
1959	1161.8	850	15.0	2027
1960	1014.7	875	15.0	1905
1961	1047.6	1068	15.0	2131
1962	927.8	710	15.0	1653
1963	997.7	796	15.0	1809
1964	665.6	604	15.0	1285
1965	845.2	712	15.0	1572
1966	685.3	936	15.0	1636
1967	794.9	877	15.0	1687
1968	661.6	811	15.0	1488
1969	1287.7	1468	15.0	2771
1970	531.6	508	15.0	1055
1971	1387.3	1514	15.0	2916
1972	858.5	1003	15.0	1876
1973	649.8	687	15.0	1352
1974	1132.1	1024	15.0	2171
1975	1035.7	908	15.0	1959
1976	874.1	845	15.0	1734
1977	605.9	601	15.0	1222
1978	893.6	758	15.0	1667

Table 21
Natural Flows at Gage No. 12-0615-00
for June

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	307.5	377	16.9	701
1945	426.2	555	16.9	998
1946	1146.3	993	16.9	2156
1947	340.7	397	16.9	755
1948	691.5	1117	16.9	1825
1949	505.9	695	16.9	1218
1950	837.2	1222	16.9	2076
1951	421.4	595	16.9	1033
1952	573.0	784	16.9	1374
1953	532.8	694	16.9	1244
1954	543.0	709	16.9	1269
1955	618.4	963	16.9	1598
1956	1213.1	1561	16.9	2791
1957	367.4	433	16.9	817
1958	322.0	556	16.9	895
1959	615.6	758	16.9	1390
1960	607.7	757	16.9	1382
1961	534.6	886	16.9	1438
1962	451.3	627	16.9	1095
1963	362.1	408	16.9	787
1964	681.2	1090	16.9	1788
1965	433.1	549	16.9	999
1966	448.4	725	16.9	1190
1967	598.0	1090	16.9	1705
1968	634.9	780	16.9	1432
1969	1057.4	1181	16.9	2255
1970	333.2	548	16.9	898
1971	899.3	1092	16.9	2008
1972	499.7	801	16.9	1318
1973	550.4	679	16.9	1246
1974	961.0	1320	16.9	2298
1975	575.4	1072	16.9	1664
1976	600.2	836	16.9	1453
1977	565.4	569	16.9	1151
1978	499.3	623	16.9	1139

AV/W48(A22-24)

Table 22
Natural Flows at Gage No. 12-0615-00
for July

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1943	296.5	270	21.5	588
1944	189.1	151	21.5	362
1945	217.5	256	21.5	495
1946	734.1	655	21.5	1411
1947	296.5	211	21.5	529
1948	310.5	382	21.5	714
1949	307.1	388	21.5	717
1950	462.1	697	21.5	1181
1951	274.0	257	21.5	552
1952	341.8	495	21.5	858
1953	346.8	596	21.5	964
1954	469.9	712	21.5	1203
1955	435.5	595	21.5	1052
1956	556.9	970	21.5	1548
1957	314.5	279	21.5	615
1958	225.4	205	21.5	452
1959	350.9	369	21.5	741
1960	319.7	351	21.5	692
1961	294.5	365	21.5	681
1962	277.2	326	21.5	625
1963	346.1	332	21.5	700
1964	438.8	619	21.5	1079
1965	249.9	258	21.5	529
1966	307.2	461	21.5	790
1967	313.6	497	21.5	832
1968	327.3	389	21.5	738
1969	333.4	375	21.5	730
1970	233.4	226	21.5	481
1971	673.8	968	21.5	1663
1972	527.7	620	21.5	1169
1973	301.7	275	21.5	598
1974	783.1	998	21.5	1803
1975	315.7	541	21.5	878
1976	458.9	600	21.5	1080
1977	225.7	163	21.5	410

Table 23
Natural Flows at Gage No. 12-0615-00
for August

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1943	197.0	109	16.9	323
1944	144.2	97	16.9	258
1945	174.9	61	16.9	253
1946	218.5	225	16.9	460
1947	202.3	96	16.9	315
1948	228.6	189	16.9	434
1949	225.0	168	16.9	410
1950	312.8	326	16.9	656
1951	198.1	108	16.9	323
1952	290.6	262	16.9	570
1953	209.6	242	16.9	468
1954	261.2	318	16.9	596
1955	305.3	256	16.9	578
1956	224.4	342	16.9	583
1957	282.7	190	16.9	490
1958	186.1	96	16.9	299
1959	229.2	137	16.9	383
1960	249.9	165	16.9	432
1961	207.4	164	16.9	388
1962	283.5	224	16.9	524
1963	218.8	163	16.9	399
1964	375.3	310	16.9	702
1965	190.2	142	16.9	349
1966	188.9	200	16.9	406
1967	198.8	199	16.9	415
1968	324.1	244	16.9	585
1969	221.7	154	16.9	393
1970	178.3	111	16.9	306
1971	313.1	452	16.9	782
1972	375.9	205	16.9	598
1973	198.6	193	16.9	409
1974	364.6	397	16.9	778
1975	388.0	418	16.9	823
1976	297.4	263	16.9	577
1977	237.8	177	16.9	432

Table 24
Natural Flows at Gage No. 12-0615-00
for September

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1943	161.3	89	11.5	262
1944	150.3	128	11.5	290
1945	224.8	173	11.5	409
1946	193.9	150	11.5	355
1947	200.7	78	11.5	290
1948	584.7	405	11.5	1001
1949	286.6	167	11.5	465
1950	213.0	152	11.5	376
1951	260.8	207	11.5	479
1952	225.1	124	11.5	361
1953	303.9	280	11.5	595
1954	266.2	200	11.5	478
1955	244.3	191	11.5	447
1956	326.6	257	11.5	595
1957	195.6	128	11.5	335
1958	173.7	114	11.5	299
1959	620.4	513	11.5	1145
1960	220.9	127	11.5	359
1961	223.0	132	11.5	366
1962	307.7	268	11.5	587
1963	186.0	112	11.5	310
1964	241.2	176	11.5	429
1965	159.6	100	11.5	271
1966	175.0	59	11.5	246
1967	187.3	143	11.5	342
1968	502.9	314	11.5	828
1969	883.6	609	11.5	1504
1970	258.6	32	11.5	302
1971	450.1	342	11.5	804
1972	491.6	393	11.5	896
1973	283.4	153	11.5	448
1974	249.9	222	11.5	483
1975	314.1	206	11.5	532
1976	224.8	170	11.5	406
1977	481.0	399	11.5	892

AV/W48(A25-27

Table 25
Natural Flows at Gage No. 12-0615-00
for October

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	470.5	504	5.3	980
1945	284.4	257	5.3	547
1946	377.5	238	5.3	621
1947	427.4	293	5.3	726
1948	2435.5	1408	5.3	3849
1949	738.6	497	5.3	1241
1950	476.1	218	5.3	699
1951	1573.7	1161	5.3	2740
1952	2162.3	943	5.3	3111
1953	169.3	98	5.3	273
1954	771.7	591	5.3	1368
1955	883.3	720	5.3	1609
1956	1331.8	841	5.3	2178
1957	1956.4	963	5.3	2925
1958	482.2	453	5.3	940
1959	507.8	440	5.3	953
1960	710.5	471	5.3	1187
1961	755.2	518	5.3	1278
1962	576.4	380	5.3	962
1963	1332.0	981	5.3	2318
1964	1296.8	1006	5.3	2308
1965	495.2	273	5.3	774
1966	526.3	353	5.3	885
1967	526.6	387	5.3	919
1968	2172.5	1697	5.3	3875
1969	1086.8	735	5.3	1827
1970	786.2	457	5.3	1248
1971	753.0	664	5.3	1422
1972	577.4	386	5.3	969
1973	262.2	77	5.3	344
1974	726.5	525	5.3	1257
1975	186.4	115	5.3	307
1976	2570.0	1744	5.3	4319
1977	220.1	178	5.3	403
1978	682.4	598	5.3	1286

Table 26
Natural Flows at Gage No. 12-0615-00
for November

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	557.3	459	2.3	1019
1945	1761.1	1396	2.3	3159
1946	1980.8	1127	2.3	3110
1947	1386.3	812	2.3	2201
1948	1278.9	608	2.3	1889
1949	1924.4	968	2.3	2895
1950	2802.1	1817	2.3	4621
1951	2273.1	1468	2.3	3743
1952	1484.9	1036	2.3	2523
1953	452.5	315	2.3	770
1954	2255.3	1577	2.3	3835
1955	3710.1	2476	2.3	6188
1956	3788.1	1789	2.3	5579
1957	1364.2	645	2.3	2012
1958	772.9	582	2.3	1357
1959	1897.9	1164	2.3	3064
1960	2151.2	1150	2.3	3304
1961	1816.0	1048	2.3	2866
1962	1247.8	911	2.3	2161
1963	2605.9	1601	2.3	4209
1964	2735.3	1814	2.3	4552
1965	1482.8	753	2.3	2238
1966	1501.2	1163	2.3	2666
1967	1297.8	1246	2.3	2546
1968	1307.2	898	2.3	2208
1969	1636.7	1058	2.3	2697
1970	963.2	804	2.3	1770
1971	1612.9	1229	2.3	2844
1972	1917.6	1287	2.3	3207
1973	1536.3	1095	2.3	2634
1974	2553.5	1429	2.3	3985
1975	1620.0	1036	2.3	2658
1976	3518.0	2002	2.3	5522
1977	464.3	302	2.3	769
1978	2470.3	1623	2.3	4096

Table 27
Natural Flows at Gage No. 12-0615-00
for December

Water Year	Gaged Flow (cfs) +	Tacoma's Natural Flow at Cushman No. 2 (cfs) +	Total Reservoir Evaporation (cfs) +	Total Natural Flow (cfs)
1944	1323.5	802	1.7	2127
1945	999.2	669	1.7	1670
1946	2467.0	1460	1.7	3929
1947	2673.7	1521	1.7	4196
1948	2073.9	1227	1.7	3303
1949	1806.9	688	1.7	2497
1950	3179.1	1510	1.7	4691
1951	4330.0	2292	1.7	6624
1952	1727.7	690	1.7	2419
1953	1863.1	1090	1.7	2955
1954	2751.6	1418	1.7	4171
1955	1754.2	1252	1.7	3008
1956	2341.0	1189	1.7	3532
1957	2433.5	1249	1.7	3684
1958	2060.8	1217	1.7	3280
1959	2355.5	1633	1.7	3990
1960	2009.4	1208	1.7	3219
1961	1895.8	1142	1.7	3040
1962	2465.0	1144	1.7	3611
1963	2272.3	1535	1.7	3809
1964	1955.7	1264	1.7	3221
1965	1654.8	908	1.7	2564
1966	1744.0	1204	1.7	2950
1967	4432.3	2909	1.7	7343
1968	2521.4	1251	1.7	3774
1969	2529.0	1478	1.7	4009
1970	2007.1	1311	1.7	3320
1971	2294.0	1175	1.7	3471
1972	1488.3	713	1.7	2203
1973	3260.9	1737	1.7	5000
1974	3753.6	2078	1.7	5833
1975	2405.6	1556	1.7	3963
1976	3626.4	1929	1.7	5557
1977	806.6	438	1.7	1246
1978	2711.7	1724	1.7	4437

AV/W48(A28-30)

Table 28
Percentage of North Fork Natural Flow ~~to Gaged Flow~~ at Gage No. 12-0615-00
(Skokomish River near Potlatch)
(By Months)

Period of Record 1943 thru 1978	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Average Natural Flow (cfs)	1196	1116	842	781	962	818	474	228	220	610	1165	1720
Average Gage Flow (cfs)	2195	2025	1575	1190	919	593	367	249	299	894	1832	2342
Percent Natural Flow ~~vs Gage Flow~~	54.5	55.1	53.4	65.7	104.7	138.0	129.3	91.7	73.7	68.3	63.6	73.4

AV/W48(B3)

Table 29. Frequency Distribution of Natural Flows at Gage No. 12-0615-00

Month/ Day	% Increase (Cushman Natural Flow to Gage Flow)	1% Occurrence		50% Occurrence		70% Occurrence		95% Occurrence		99% Occurrence	
		Gage Flow (cfs)	Natural Flow (Gage + % Increase)	Gage Flow (cfs)	Natural Flow (Gage + % Increase)	Gage Flow (cfs)	Natural Flow (Gage + % Increase)	Gage Flow (cfs)	Natural Flow (Gage + % Increase)	Gage Flow (cfs)	Natural Flow (Gage + % Increase)
Jan 1	63.95	8,800	14,400	1,470	2,410	955	1,570	600	985	455	745
15	54.5	13,400	20,700	1,690	2,610	980	1,510	510	790	460	710
Feb 1	54.8	9,600	14,900	1,490	2,310	960	1,490	460	710	333	515
15	55.1	9,000	14,000	1,450	2,250	1,080	1,675	680	1,055	518	805
Mar 1	54.25	10,300	15,900	1,180	1,820	920	1,420	620	955	486	750
15	53.4	6,800	10,400	1,170	1,790	855	1,310	600	920	540	830
Apr 1	59.55	4,900	7,800	1,200	1,910	970	1,550	600	955	522	835
15	65.7	4,250	7,040	1,020	1,690	840	1,390	600	995	480	795
May 1	85.2	2,570	4,760	960	1,780	765	1,420	570	1,055	390	720
15	104.7	2,500	5,100	850	1,740	695	1,420	480	985	420	860
Jun 1	121.35	2,340	5,200	675	1,490	575	1,275	380	840	328	725
15	138.0	1,630	3,880	535	1,270	440	1,050	310	740	288	685
Jul 1	133.65	1,540	3,600	400	930	340	795	255	595	225	525
15	129.3	1,510	3,460	312	715	280	640	206	470	182	415
Aug 1	110.5	770	1,620	250	525	230	485	186	390	158	335
15	91.7	440	840	215	415	200	385	167	320	144	275
Sep 1	82.7	1,210	2,210	211	385	185	340	157	285	130	240
15	73.7	1,880	3,270	209	363	185	320	157	275	132	230
Oct 1	71.0	2,600	4,450	250	428	190	325	155	265	141	240
15	68.3	6,200	10,400	470	790	255	430	159	270	150	250
Nov 1	65.95	5,900	9,800	865	1,435	515	855	172	285	165	275
15	63.6	11,400	18,700	1,280	2,090	860	1,410	370	605	242	395
Dec 1	68.5	10,250	17,300	1,820	3,070	1,100	1,850	418	705	287	485
15	73.4	9,800	17,000	1,700	2,950	1,160	2,010	580	1,005	428	745

AV/W48(B27-28)

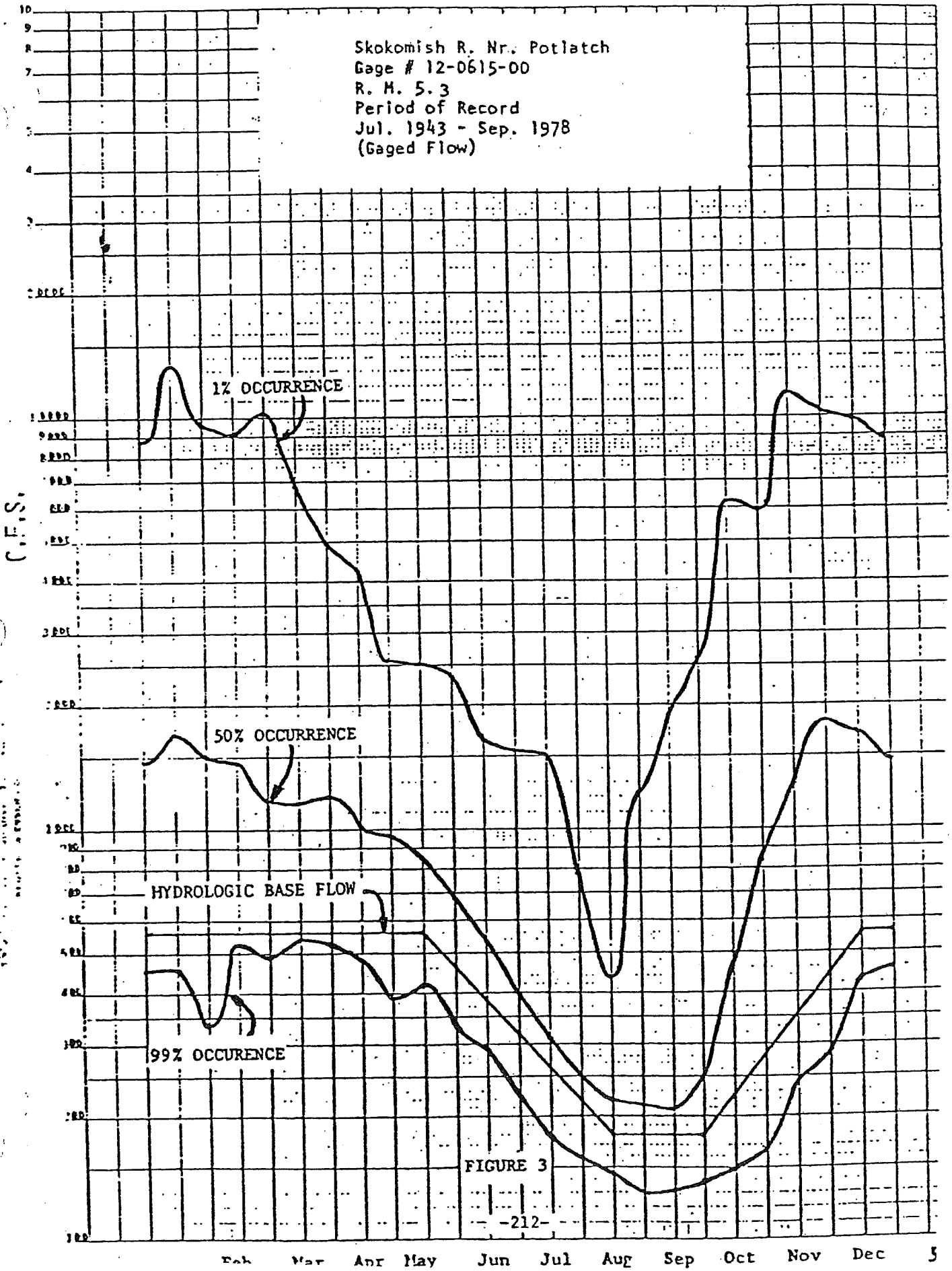

Skokomish R. Nr. Potlatch
Gage # 12-0615-00
R. M. 5.3
Period of Record
Jul. 1943 - Sep. 1978
(Gaged Flow)
1% OCCURRENCE
50% OCCURRENCE
HYDROLOGIC BASE FLOW
99% OCCURENCE
C.F.S.
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

FIGURE 3

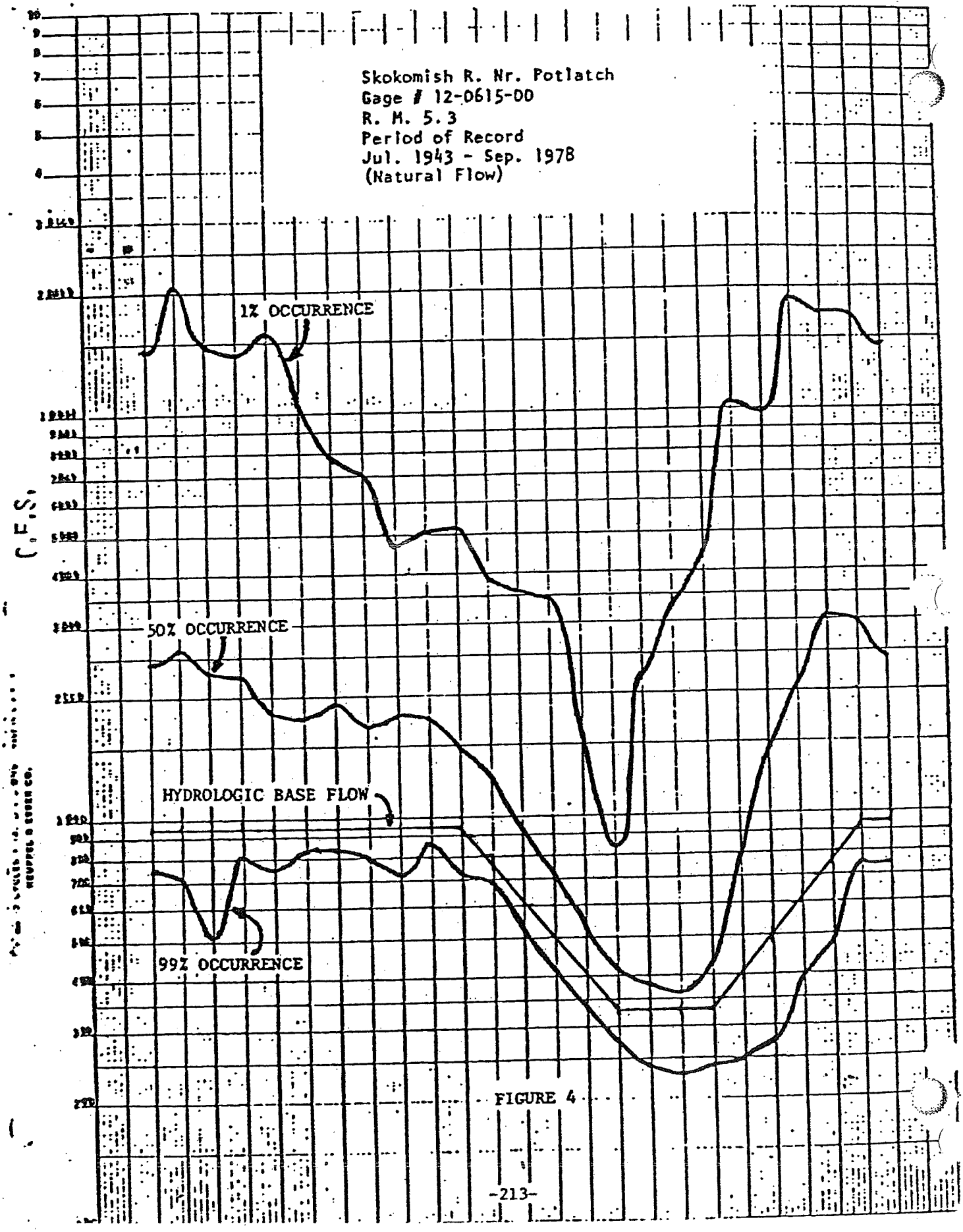

Skokomish R. Nr. Potlatch
Gage # 12-0615-00
R. M. 5.3
Period of Record
Jul. 1943 - Sep. 1978
(Natural Flow)
1% OCCURRENCE
50% OCCURRENCE
HYDROLOGIC BASE FLOW
99% OCCURRENCE

FIGURE 4

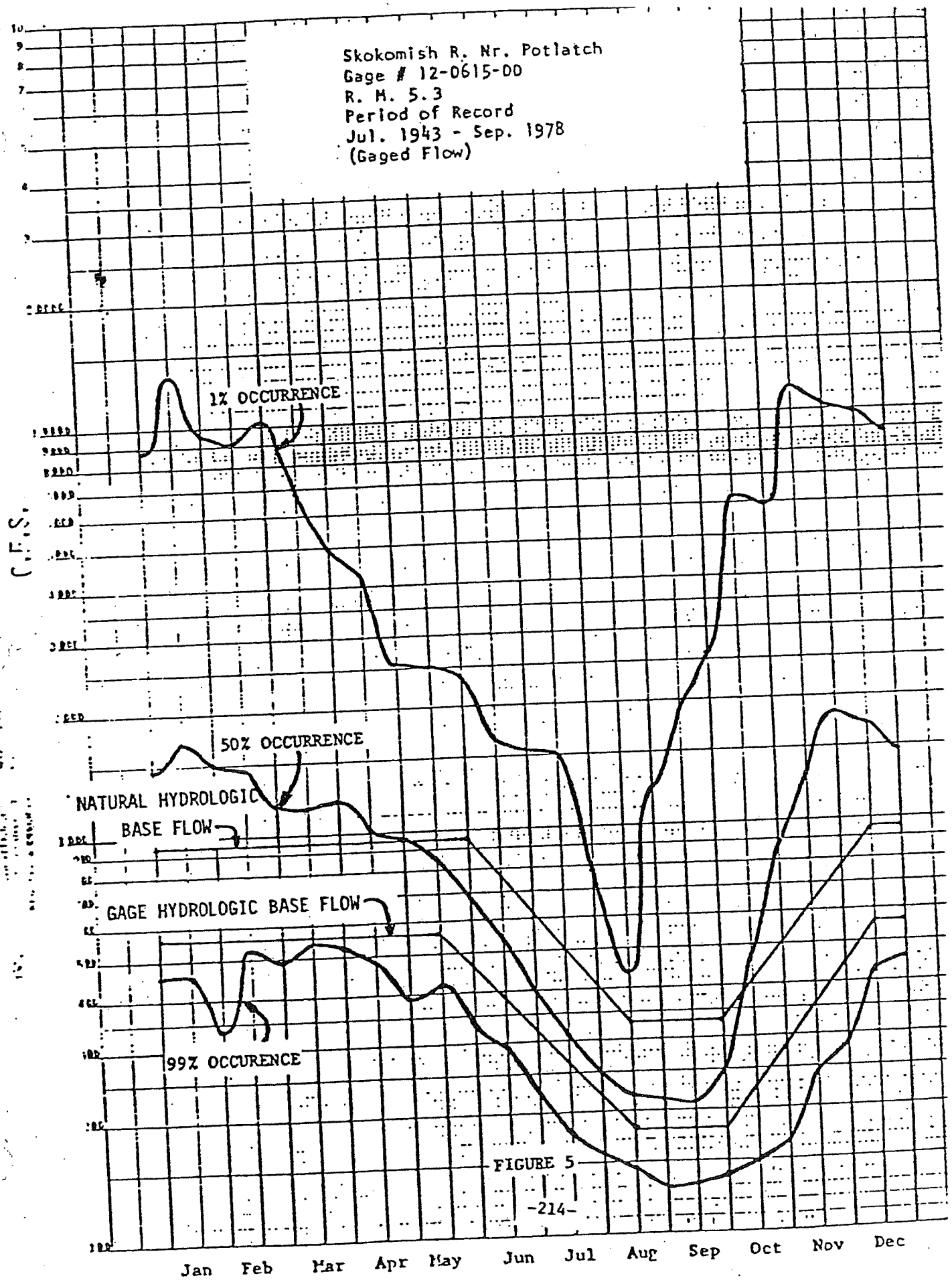

Skokomish R. Nr. Potlatch
Gage # 12-0615-00
R. M. 5.3
Period of Record
Jul. 1943 - Sep. 1978
(Gaged Flow)
1% OCCURRENCE
50% OCCURRENCE
NATURAL HYDROLOGIC
BASE FLOW
GAGE HYDROLOGIC BASE FLOW
99% OCCURENCE
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

FIGURE 5

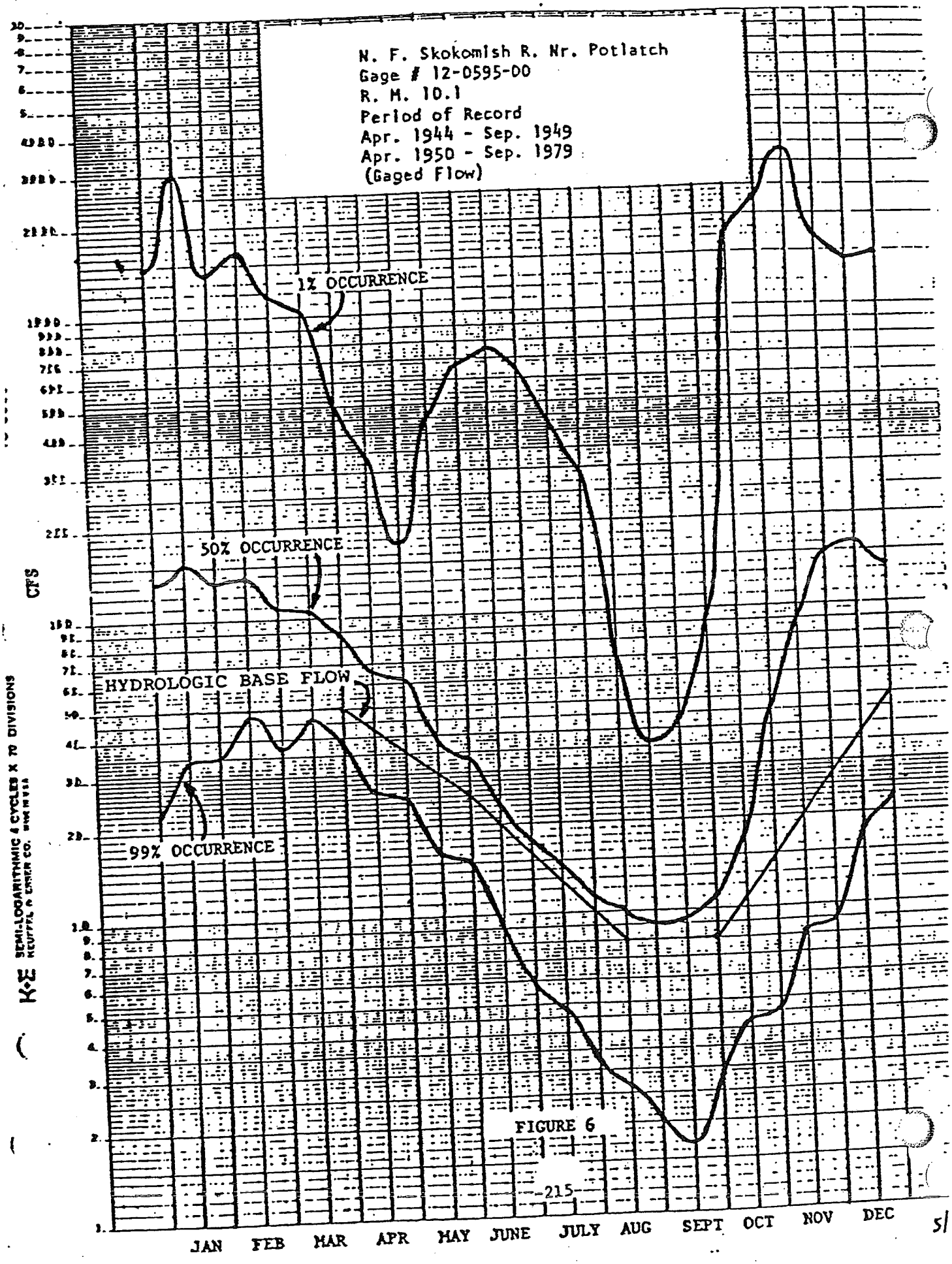

N. F. Skokomish R. Nr. Potlatch
Gage # 12-0595-00
R. M. 10.1
Period of Record
Apr. 1944 - Sep. 1949
Apr. 1950 - Sep. 1979
(Gaged Flow)
1% OCCURRENCE
50% OCCURRENCE
HYDROLOGIC BASE FLOW
99% OCCURRENCE
CFS
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO.

FIGURE 6

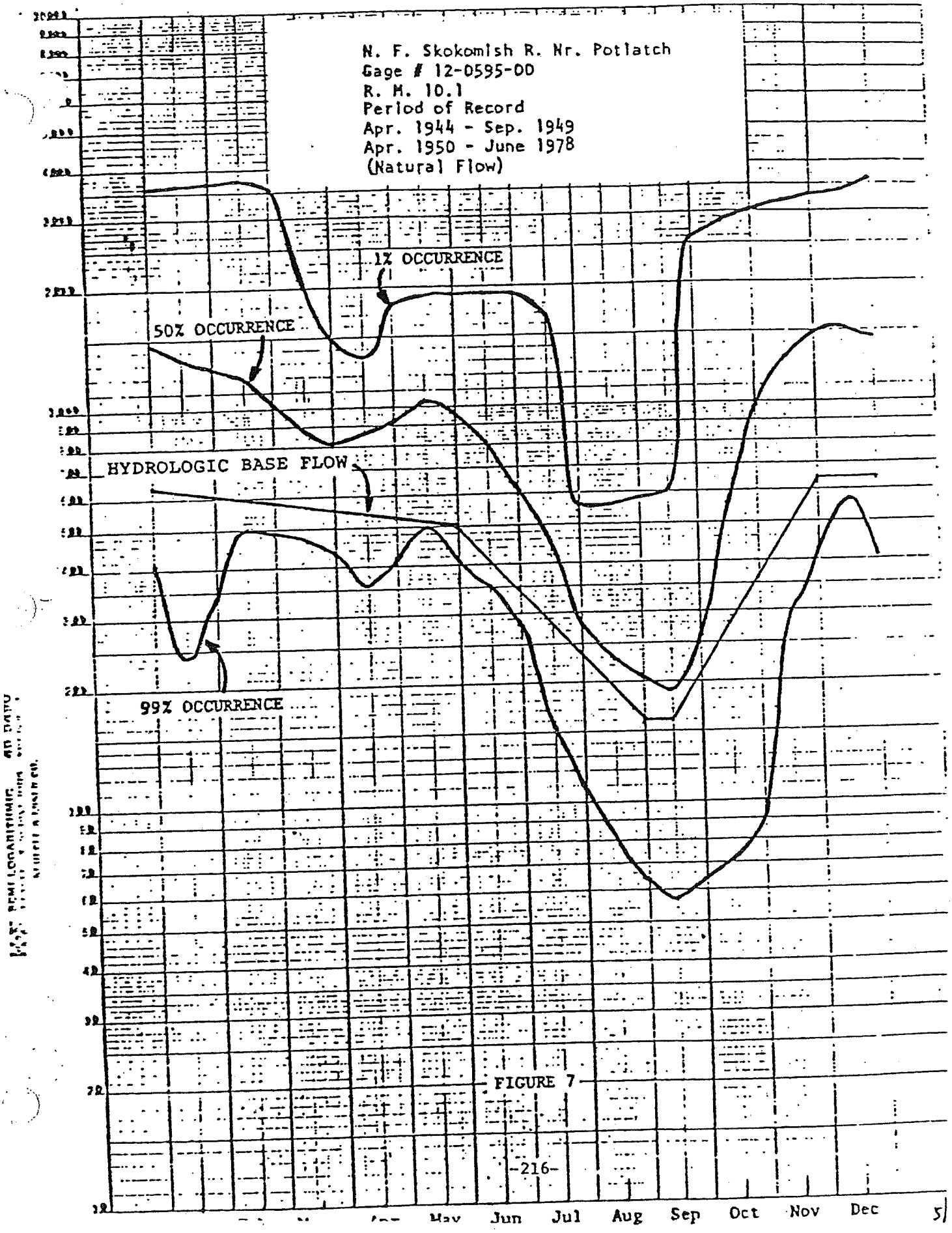

N. F. Skokomish R. Nr. Potlatch
Gage # 12-0595-00
R. M. 10.1
Period of Record
Apr. 1944 - Sep. 1949
Apr. 1950 - June 1978
(Natural Flow)
1% OCCURRENCE
50% OCCURRENCE
HYDROLOGIC BASE FLOW
99% OCCURRENCE
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

FIGURE 7

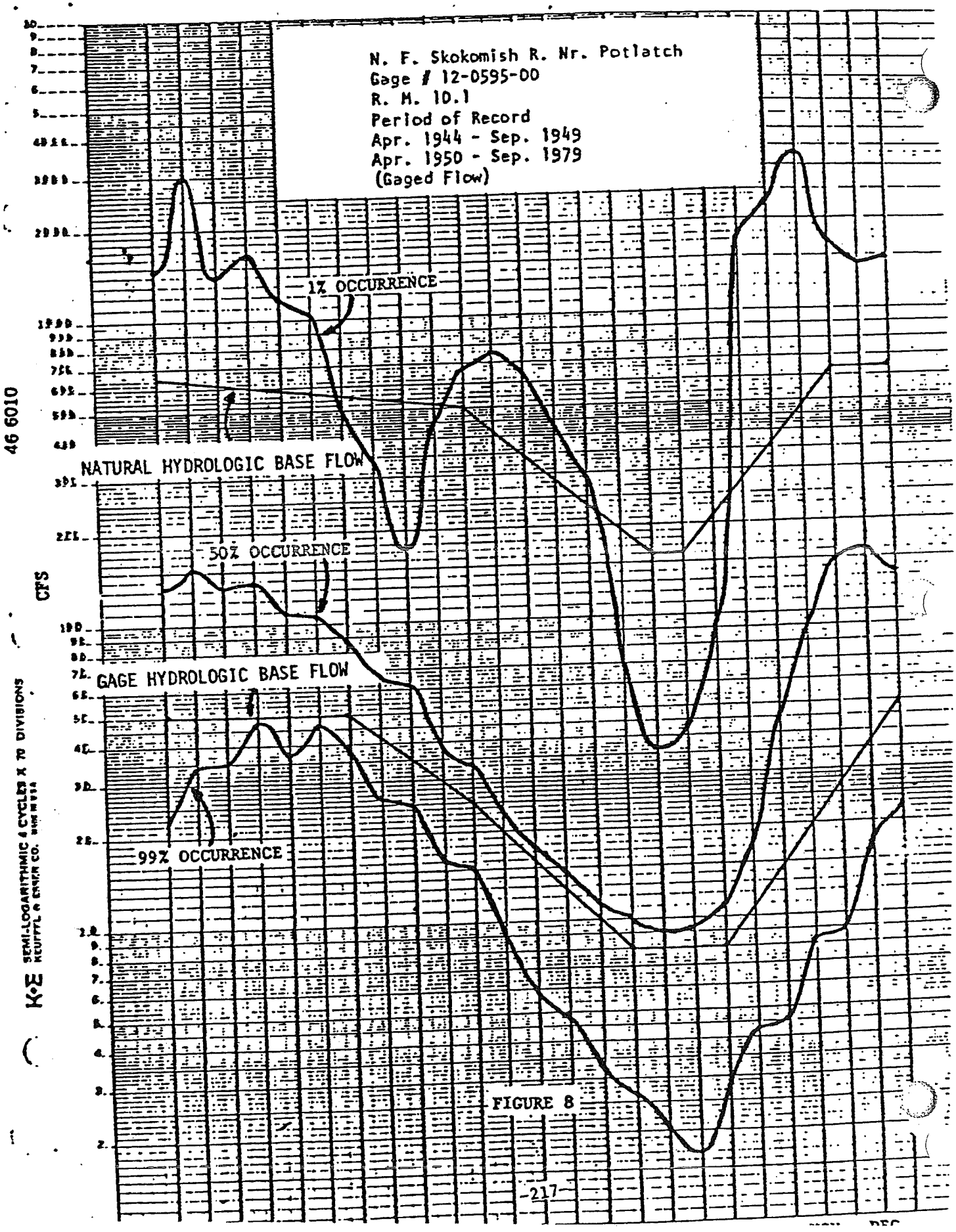

N. F. Skokomish R. Nr. Potlatch
Gage # 12-0595-00
R. M. 10.1
Period of Record
Apr. 1944 - Sep. 1949
Apr. 1950 - Sep. 1979
(Gaged Flow)
1% OCCURRENCE
NATURAL HYDROLOGIC BASE FLOW
50% OCCURRENCE
GAGE HYDROLOGIC BASE FLOW
99% OCCURRENCE
CFS
46 6010
K+E SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO.

FIGURE 8

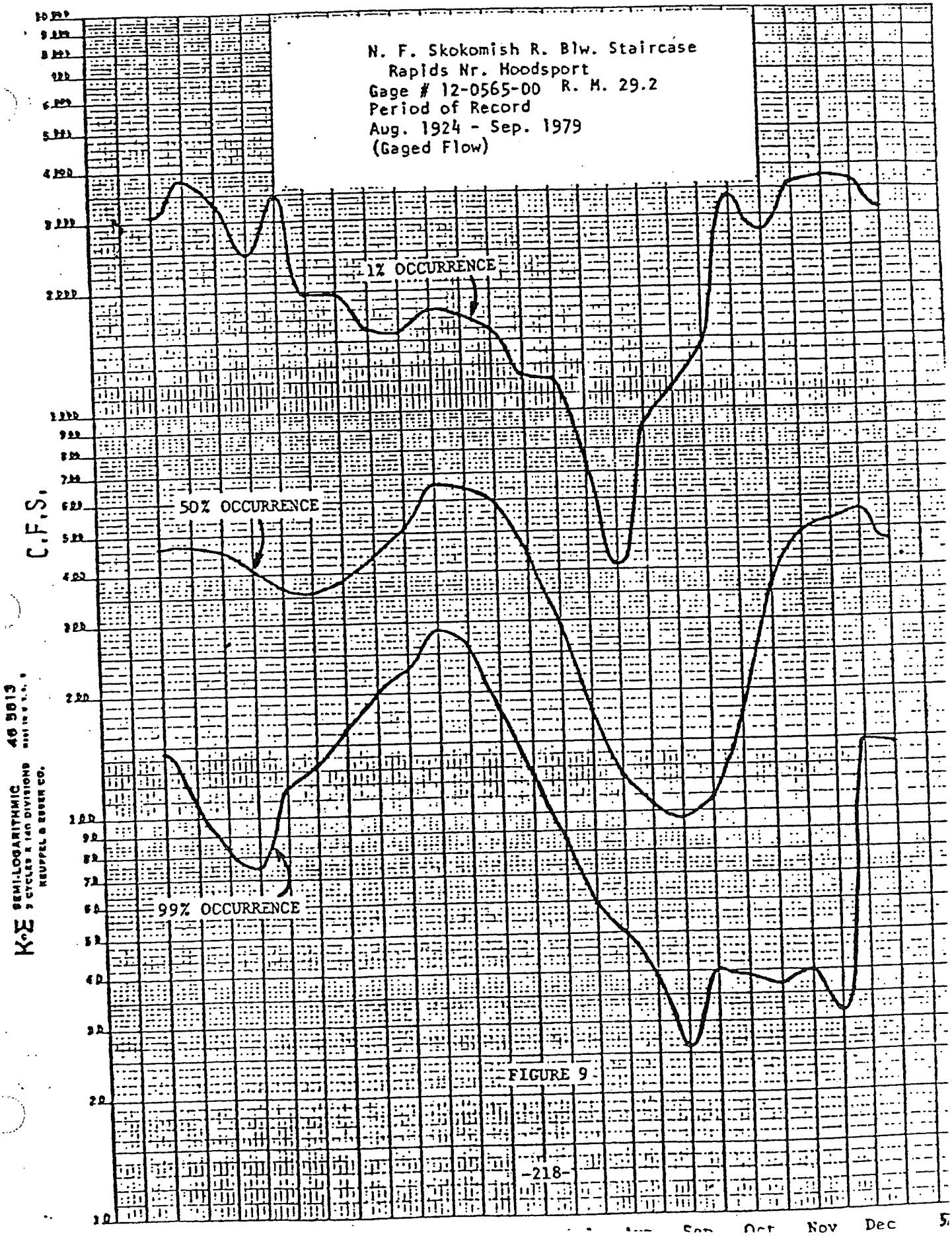
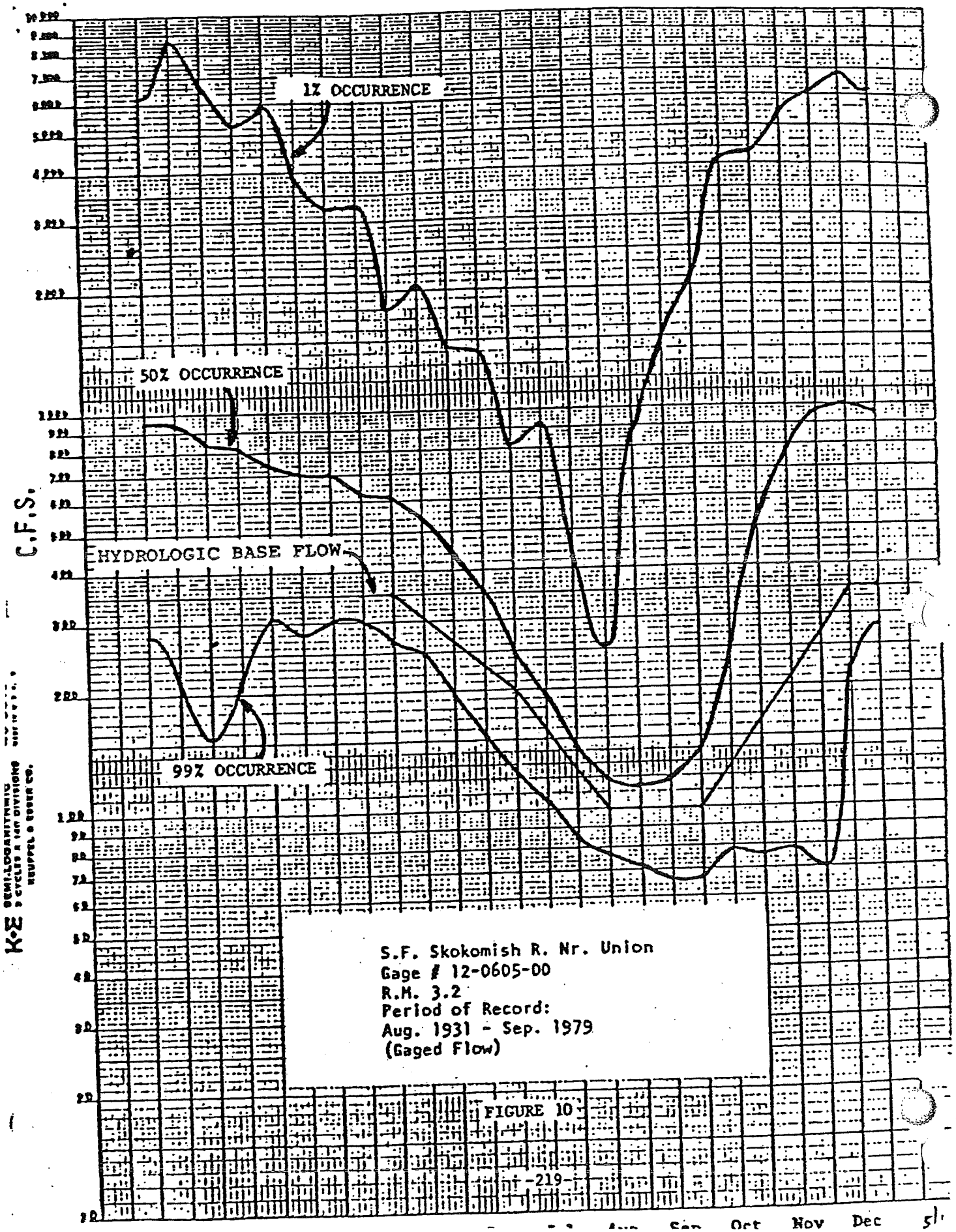

N. F. Skokomish R. Blw. Staircase
Rapids Nr. Hoodsport
Gage # 12-0565-00 R. M. 29.2
Period of Record
Aug. 1924 - Sep. 1979
(Gaged Flow)
1% OCCURRENCE
50% OCCURRENCE
99% OCCURRENCE
C.F.S.
Sep
Oct
Nov
Dec

FIGURE 9



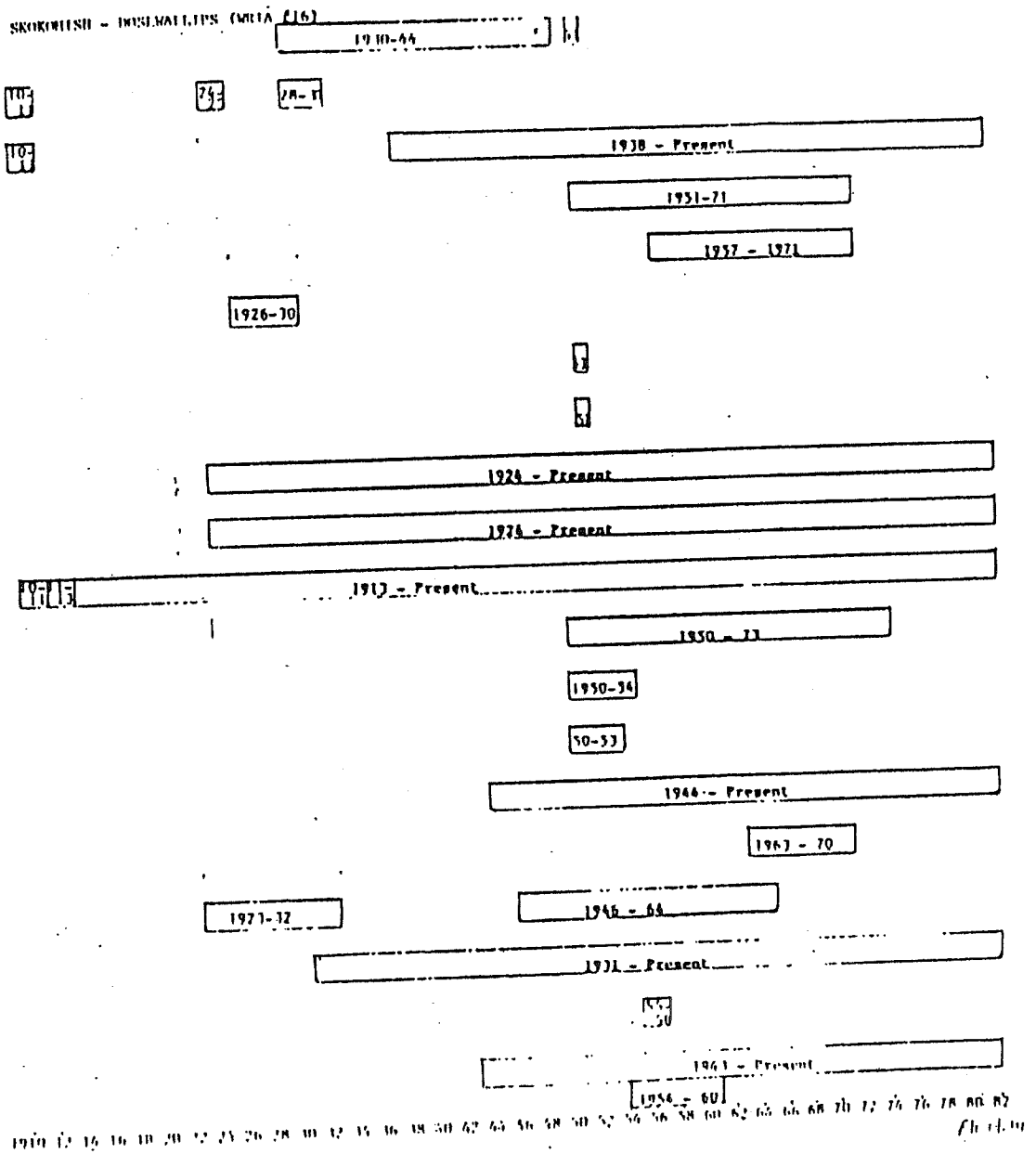
S.F. Skokomish R. Nr. Union
Gage # 12-0605-00
R.M. 3.2
Period of Record:
Aug. 1931 - Sep. 1979
(Gaged Flow)

FIGURE 10

FIGURE 11

STREAM & GAGE NUMBER

Donevallips R. Nr. Brinnon	Gage #12-0530-00
Donevallips R. at Brinnon	Gage #12-0535-00
Duckabush R. Nr. Brinnon	Gage #12-0540-00
Hamma Hamma River Nr. Eldon	Gage #12-0545-00
Jefferson Cr. Nr. Eldon	Gage #12-0546-00
Hamma Hamma R. Nr. Hoodsport	Gage #12-0550-00
Eagle Cr. Nr. Lilliwaup	Gage #12-0555-00
Finch Cr. at Hoodsport	Gage #12-0560-00
N.F. Skokomish R. Blw. Staircase Rapids Nr. Hoodsport	Gage #12-0565-00
Lake Cushman Nr. Hoodsport	Gage #12-0570-00
N.F. Skokomish R. Nr. Hoodsport	Gage #12-0575-00
Deer Meadow Cr. Nr. Hoodsport	Gage #12-0580-00
Dow Cr. Nr. Hoodsport	Gage #12-0585-00
McTaggart Cr. Nr. Hoodsport	Gage #12-0590-00
N.F. Skokomish R. Nr. Potlatch	Gage #12-0595-00
S.F. Skokomish R. Nr. Hoodsport	Gage #12-0598-00
S.F. Skokomish R. Nr. Potlatch	Gage #12-0600-00
S.F. Skokomish R. Nr. Union	Gage #12-0605-00
Vance Cr. Nr. Potlatch	Gage #12-0610-00
Skokomish R. Nr. Potlatch	Gage #12-0615-00
Purdy Cr. Nr. Union	Gage #12-0625-00



CONVERSION TABLES

(U. S. and Metric)

VOLUME

Unit		Liters	U.S. Gallons	Cubic Feet	Cubic Meters	Acre-Feet
1 Liter	=	1.0	0.2642	0.0353	0.001	0.00000081
1 U.S. Gallon	=	3.785	1.0	0.134	0.00379	0.00000307
1 Cubic Foot (62.4 lbs water)	=	28.317	7.481	1.0	0.02832	0.0000230
1 Cubic Meter	=	1,000	264.2	35.315	1.0	0.0008107
1 Acre-Foot	=	1,233,500	325,851	43,560	1,233.5	1.0

1 U.S. Gallon = 231 cubic inches = 0.83 Imperial Gallons (= 8.3 pounds of water)

1 Liter = 1,000 cubic centimeters = 1.05 quarts (= 1,000 grams of water)

1 Cubic Hectometer = 810.7 acre-feet

RATE OF FLOW

Unit		gpm	cfs	mgd	cu m/sec	maf/yr
1 U.S. Gallon per Minute (gpm)	=	1.0	0.002228	0.001440	0.0000631	0.0000016
1 Cubic Foot per Second (cfs)	=	448.8	1.0	0.6463	0.02832	0.000724
1 Million U.S. Gallons per Day (mgd)	=	694.4	1.547	1.0	0.04381	0.00112
1 Cubic Meter per Second (cu m/sec)	=	15,850	35.31	22.82	1.0	0.0255
1 Million Acre-Feet per year (maf/yr)	=	619,960	1,381	892.9	39.1	1.0

1 Liter per second = 15.85 gallons per minute

1 Cubic Foot per Second = 1.98 acre-feet per day = 724 acre-feet per year

Other

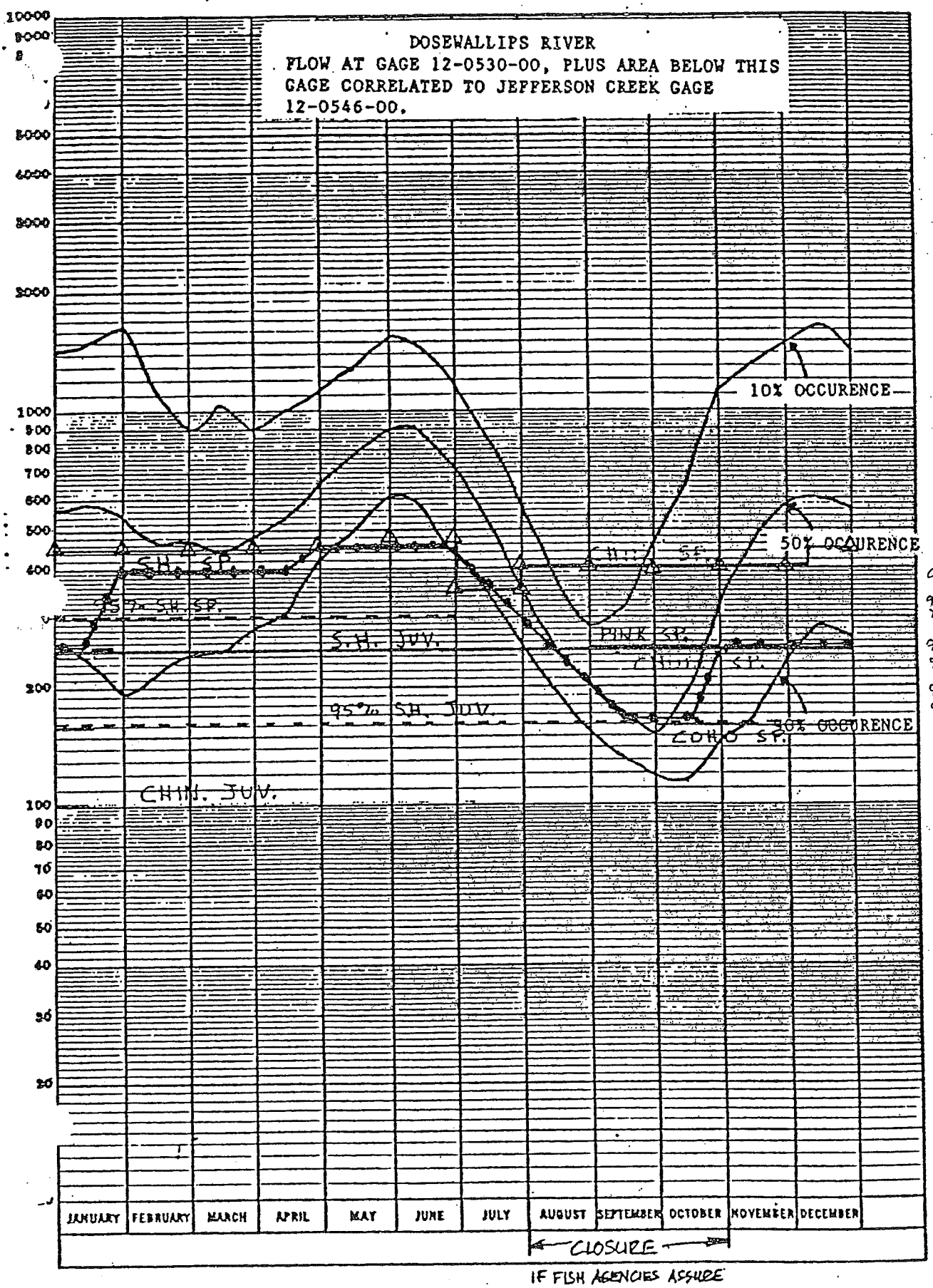
1 Acre = 43,560 square feet (209 x 209 feet) = 0.405 hectare

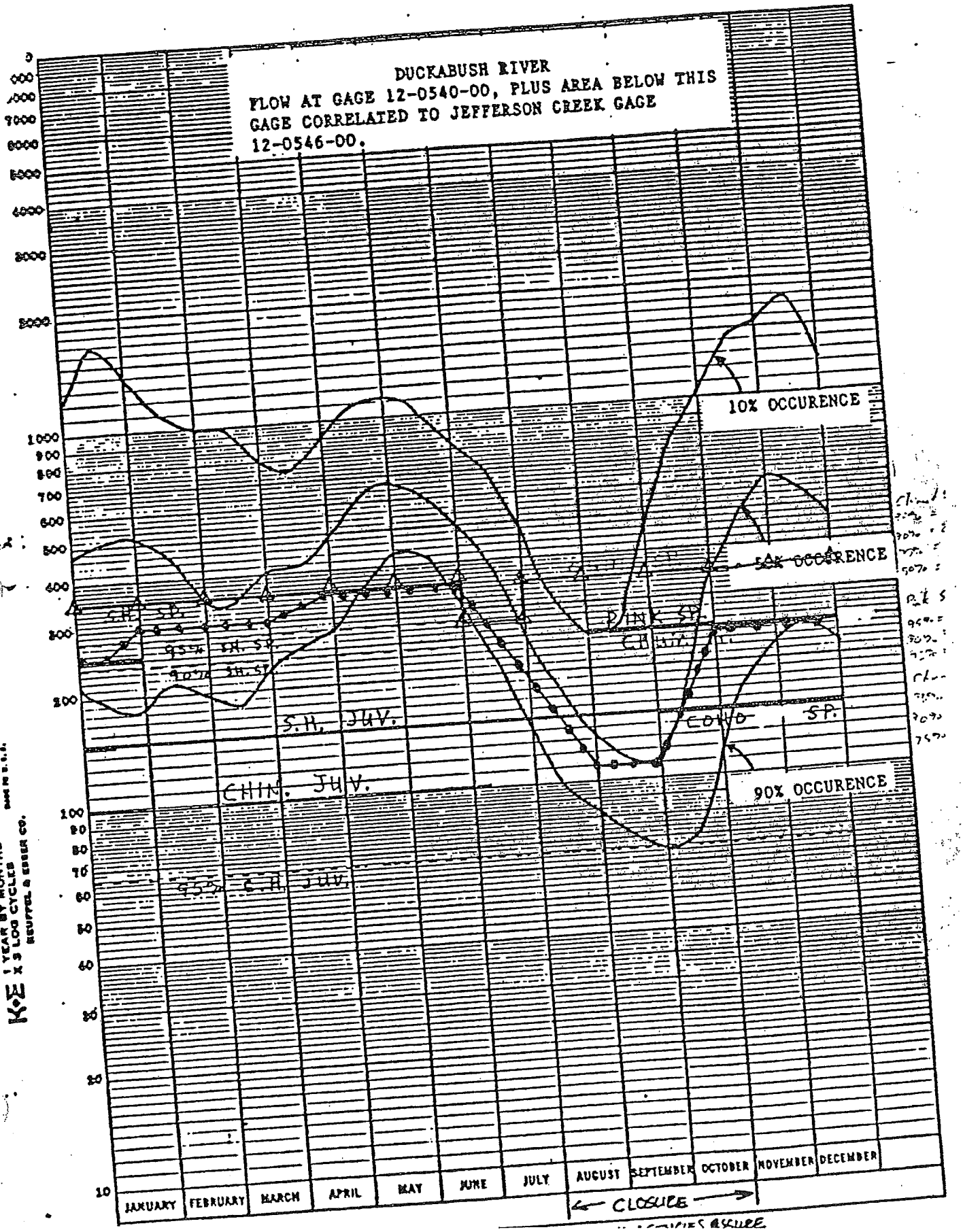
1 Hectare = 10,000 square meters = 0.01 square kilometer = 2.47 acres

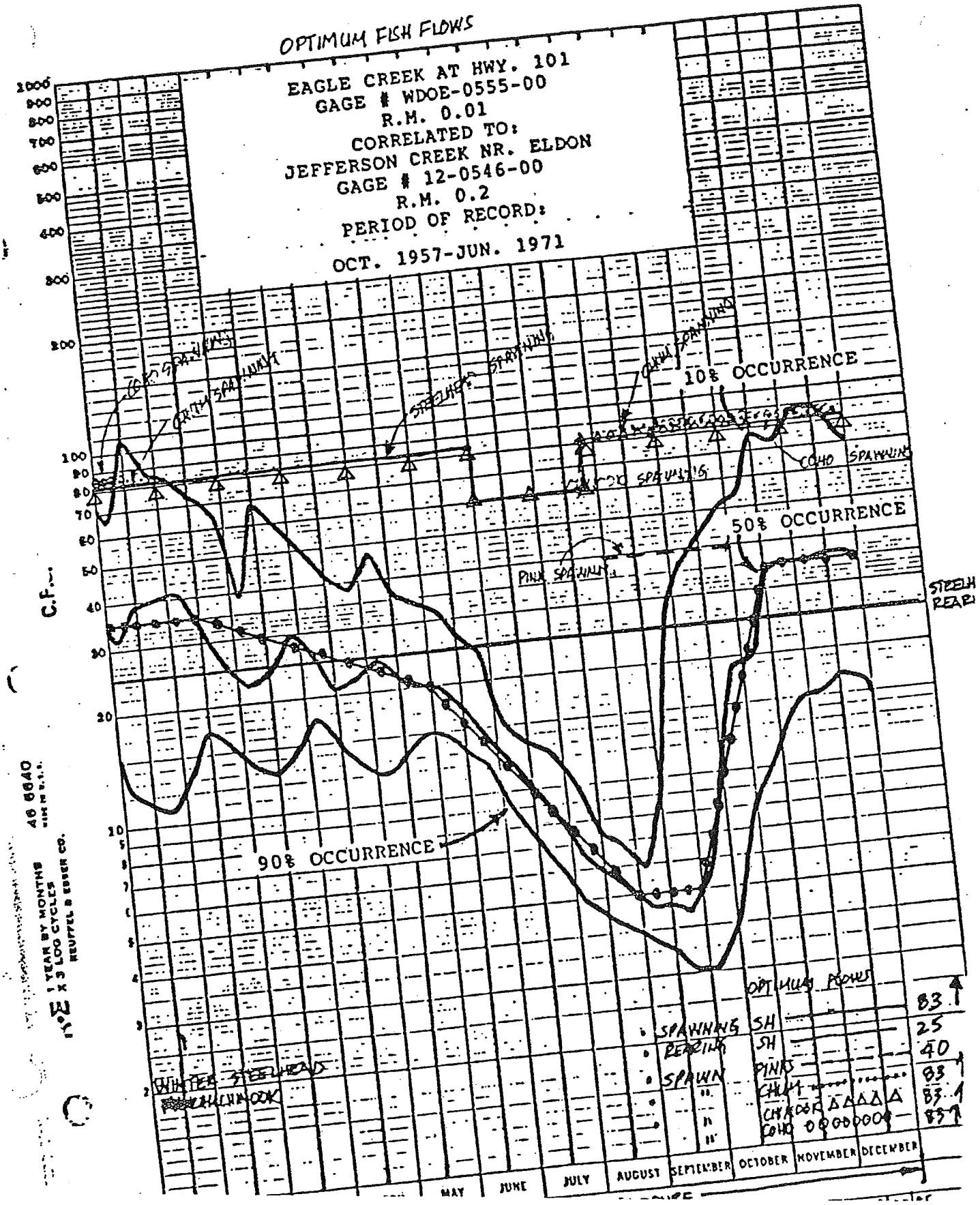
1 Kilowatt-hour (KWH) = 0.001 megawatt-hour (MWH) = 3,413 BTU

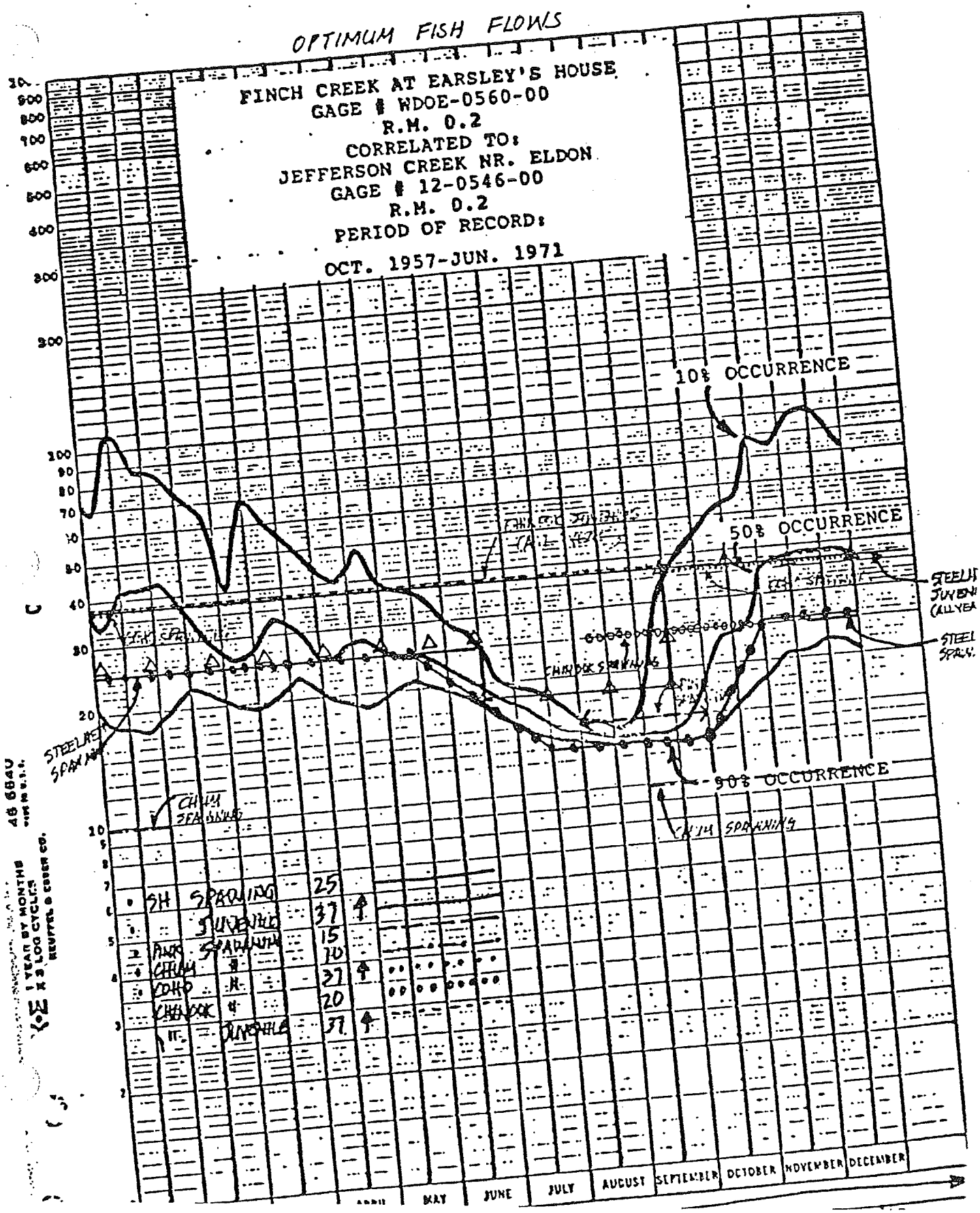
TABLE 30

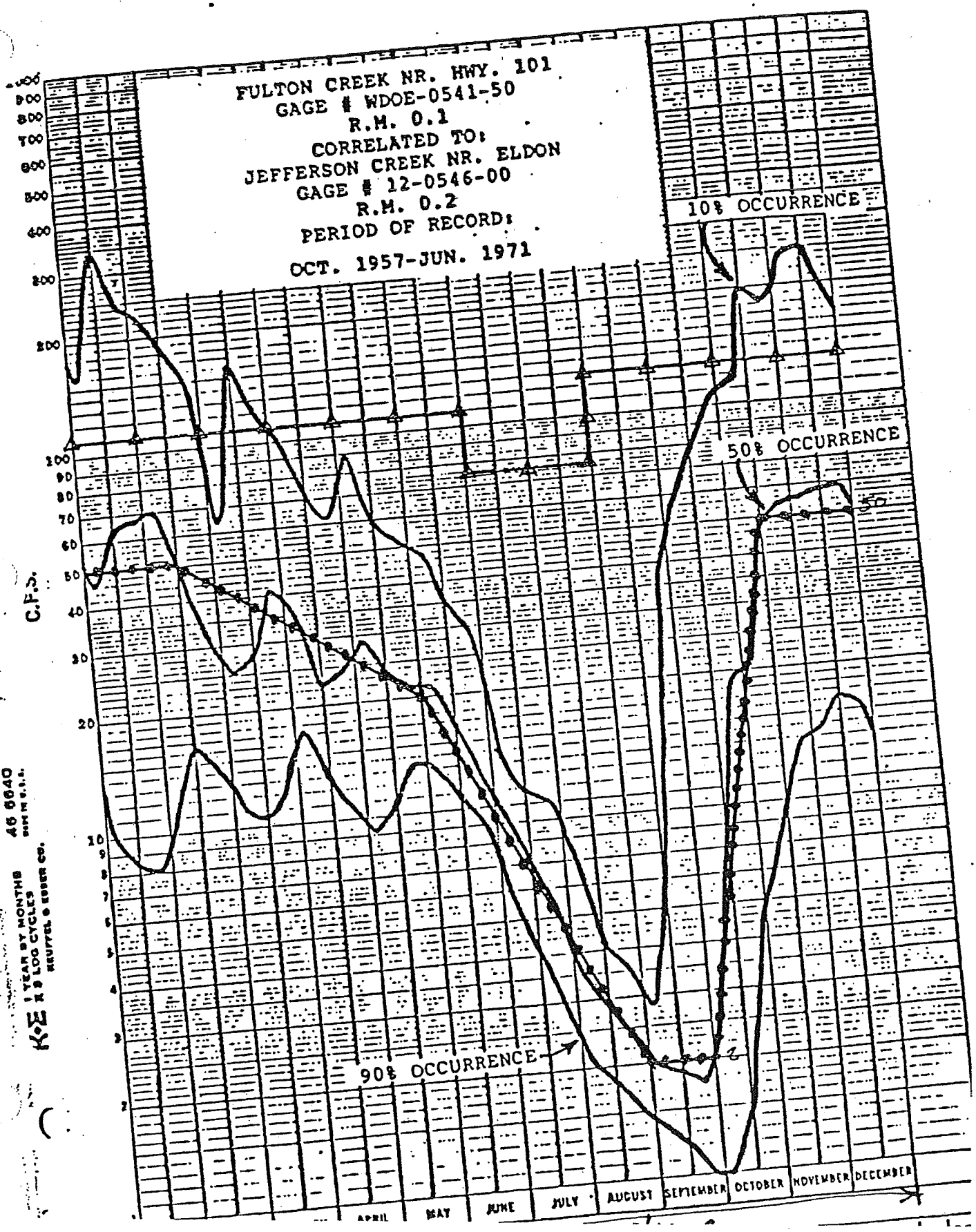
IFIM Notes and Information


DOSEWALLIPS RIVER
FLOW AT GAGE 12-0530-00, PLUS AREA BELOW THIS GAGE CORRELATED TO JEFFERSON CREEK GAGE 12-0546-00.
10000
9000
8000
6000
5000
4000
3000
2000
1000
900
800
700
600
500
400
200
100
90
80
70
60
50
40
30
20
10% OCCURENCE
50% OCCURENCE
90% OCCURENCE
95% S.H. SP.
S.H. SP.
S.H. JUV.
95% S.H. JUV.
CHIN. JUV.
CHIN. SP.
PINK SP.
COHO SP.
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
CLOSURE
IF FISH AGENCIES ASSURE
95% chin. 27
90% chin. 23
75% chin. 18
95% Pink 16
90% Pink 15
95% Chum 17
90% Chum 14

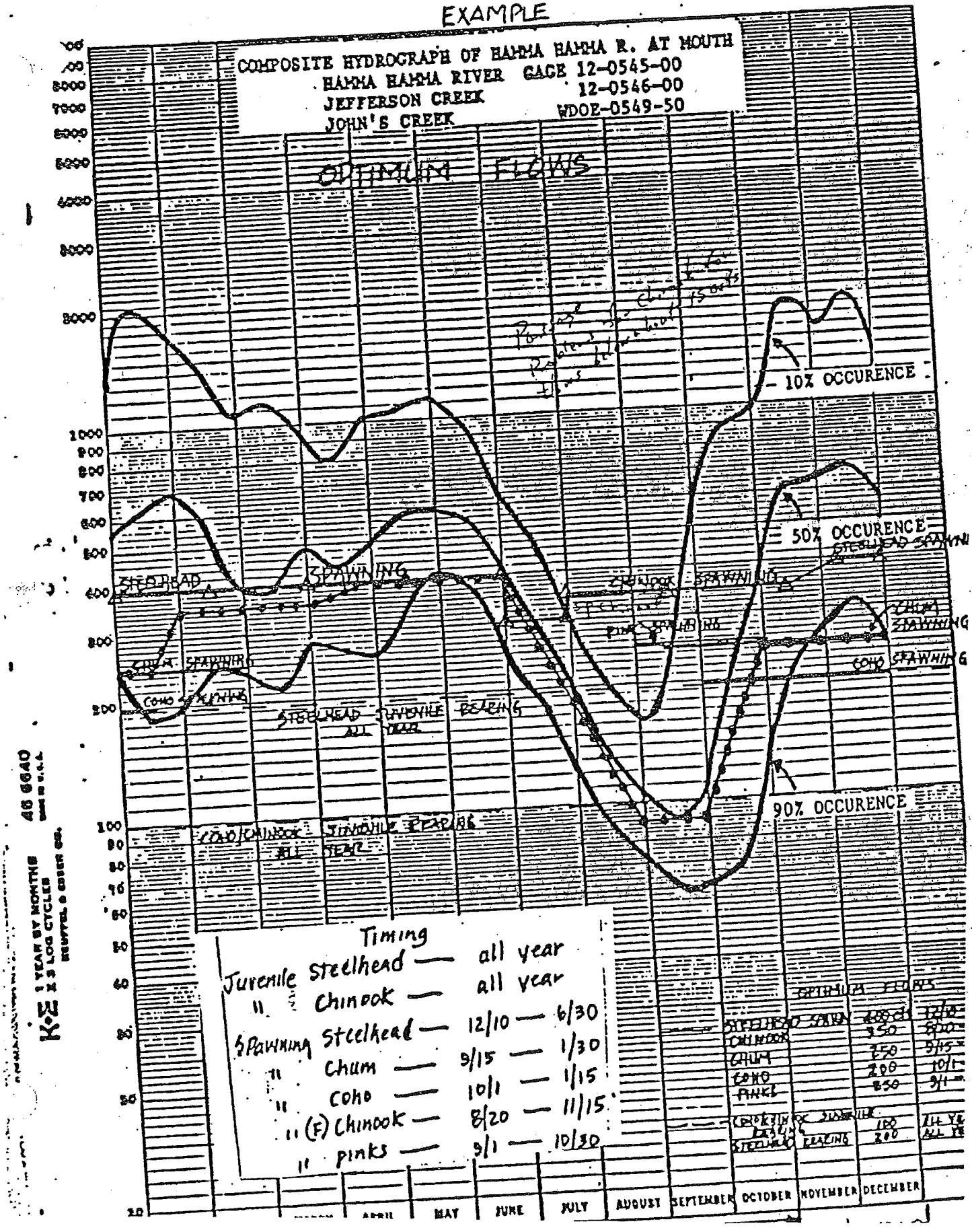

DUCKABUSH RIVER
FLOW AT GAGE 12-0540-00, PLUS AREA BELOW THIS GAGE CORRELATED TO JEFFERSON CREEK GAGE 12-0546-00.
10% OCCURENCE
50% OCCURENCE
90% OCCURENCE
CHIN. SP.
95% SH. ST.
90% SH. ST.
S.H. JUV.
CHIN. JUV.
95% C.H. JUV.
PINK SP.
COHO SP.
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
← CLOSURE →
1 YEAR BY MONTHS X 3 LOG CYCLES
KEUFFEL & ESSER CO.
46 6640

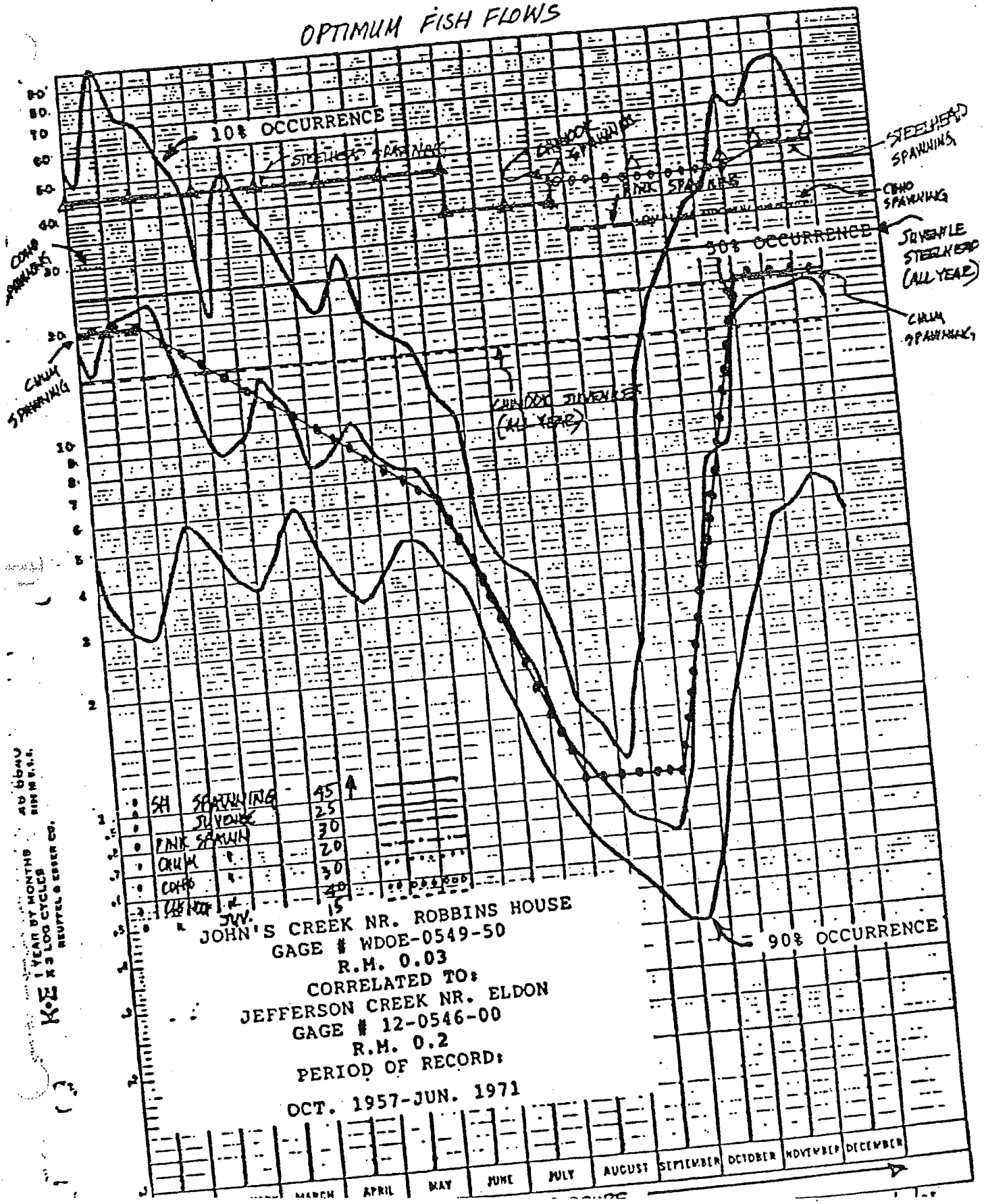

OPTIMUM FISH FLOWS
EAGLE CREEK AT HWY. 101
GAGE # WDOE-0555-00
R.M. 0.01
CORRELATED TO:
JEFFERSON CREEK NR. ELDON
GAGE # 12-0546-00
R.M. 0.2
PERIOD OF RECORD:
OCT. 1957-JUN. 1971
10% OCCURRENCE
50% OCCURRENCE
90% OCCURRENCE
C.F.S.
COHO SPAWNING
PINK SPAWNING
STEELH
REARI
WINTER STEELHEAD
CHINOOK
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
OPTIMUM FLOWS
SPAWNING SH
REARING SH
SPAWN PINK
CHUM
CHINOOK
COHO
83
25
40
83
83
83
46 6640
1 YEAR BY MONTHS
X 3 LOG CYCLES
KEUFFEL & ESSER CO.


OPTIMUM FISH FLOWS
FINCH CREEK AT EARSLEY'S HOUSE
GAGE # WDOE-0560-00
R.M. 0.2
CORRELATED TO:
JEFFERSON CREEK NR. ELDON
GAGE # 12-0546-00
R.M. 0.2
PERIOD OF RECORD:
OCT. 1957-JUN. 1971
10% OCCURRENCE
50% OCCURRENCE
90% OCCURRENCE
CHUM SPAWNING
CHINOOK SPAWNING
STEELHEAD SPAWNING
SH SPAWNING
JUVENILE
COHO
CHINOOK
JUVENILE
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
46 6842
1 YEAR BY MONTHS
X 3 LOG CYCLES
KEUFFEL & ESSER CO.


FULTON CREEK NR. HWY. 101
GAGE # WDOE-0541-50
R.M. 0.1
CORRELATED TO:
JEFFERSON CREEK NR. ELDON
GAGE # 12-0546-00
R.M. 0.2
PERIOD OF RECORD:
OCT. 1957-JUN. 1971
10% OCCURRENCE
50% OCCURRENCE
90% OCCURRENCE
C.F.S.
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
46 6640
1 YEAR BY MONTHS
X 3 LOG CYCLES
KEUFFEL & ESSER CO.

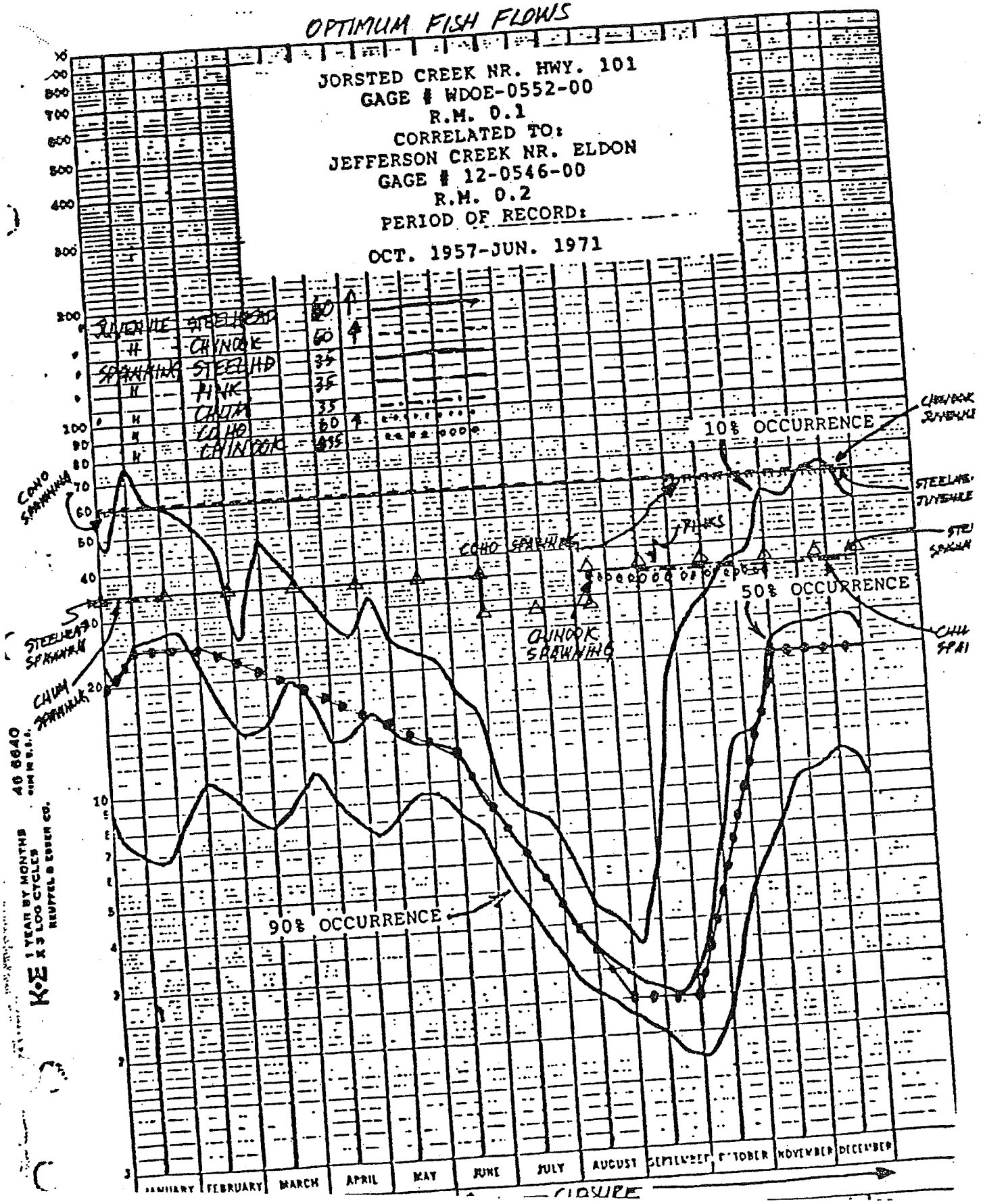
EXAMPLE


COMPOSITE HYDROGRAPH OF HAMMA HAMMA R. AT MOUTH
HAMMA HAMMA RIVER GAGE 12-0545-00
JEFFERSON CREEK 12-0546-00
JOHN'S CREEK WDOE-0549-50
OPTIMUM FLOWS
10% OCCURENCE
50% OCCURENCE
90% OCCURENCE
STEELHEAD SPAWNING
CHUM SPAWNING
COHO SPAWNING
STEELHEAD JUVENILE REARING ALL YEAR
COHO/CHINOOK JUVENILE REARING ALL YEAR
Timing
Juvenile Steelhead — all year
" Chinook — all year
Spawning Steelhead — 12/10 — 6/30
" Chum — 9/15 — 1/30
" Coho — 10/1 — 1/15
" (F) Chinook — 8/20 — 11/15
" pinks — 9/1 — 10/30
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER


OPTIMUM FISH FLOWS
10% OCCURRENCE
50% OCCURRENCE
90% OCCURRENCE
STEELHEAD SPAWNING
COHO SPAWNING
CHUM SPAWNING
PINK SPAWNERS
STEELHEAD JUVENILES (ALL YEAR)
CHINOOK JUVENILES (ALL YEAR)
COHO SPAWNING
CHUM SPAWNING
SH SPAWNING
SH JUVENILE
PINK SPAWN
CHUM
COHO
CHINOOK JUV.
JOHN'S CREEK NR. ROBBINS HOUSE
GAGE # WDOE-0549-50
R.M. 0.03
CORRELATED TO:
JEFFERSON CREEK NR. ELDON
GAGE # 12-0546-00
R.M. 0.2
PERIOD OF RECORD:
OCT. 1957-JUN. 1971
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
1 YEAR BY MONTHS
X 3 LOG CYCLES
KEUFFEL & ESSER CO.

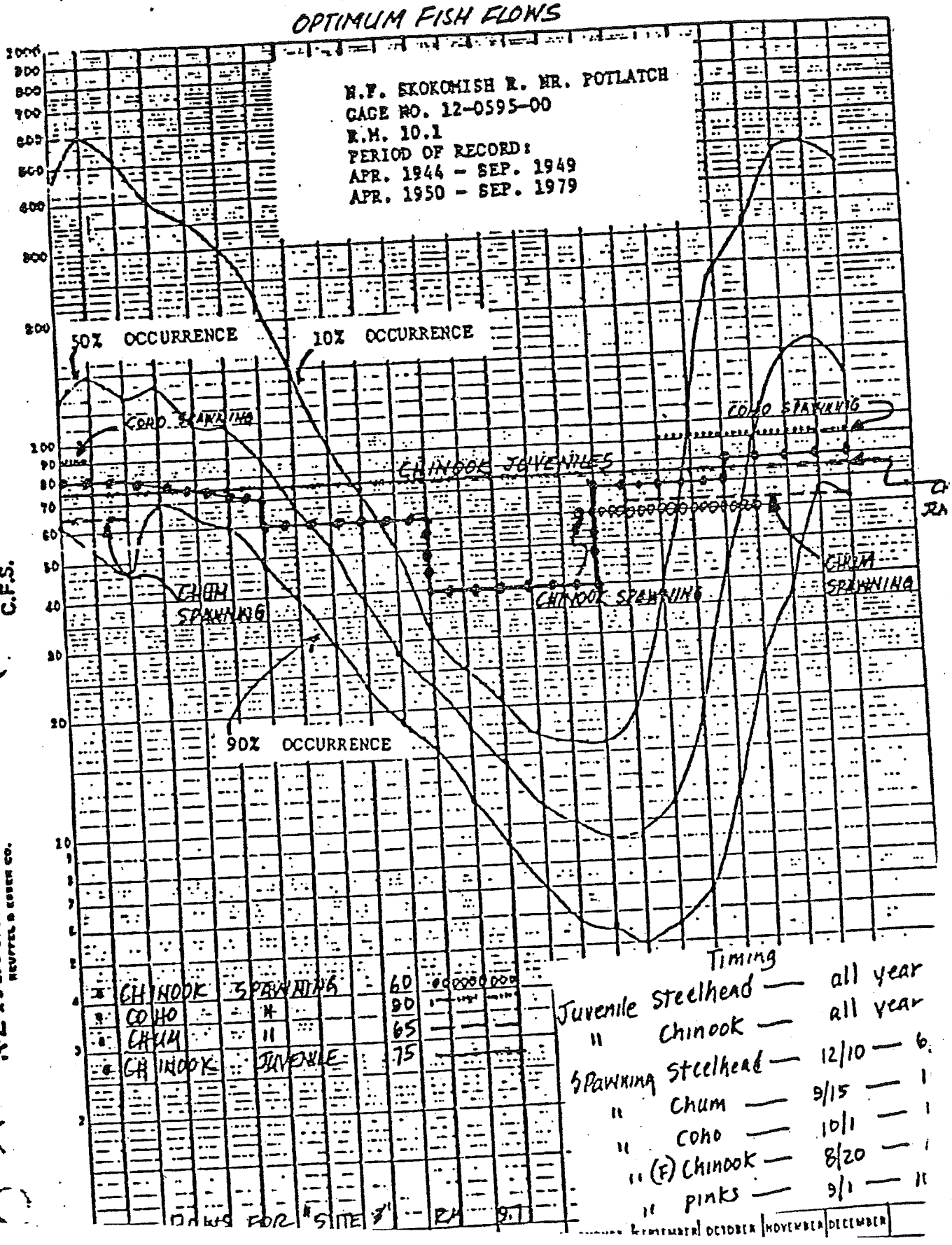
OPTIMUM FISH FLOWS

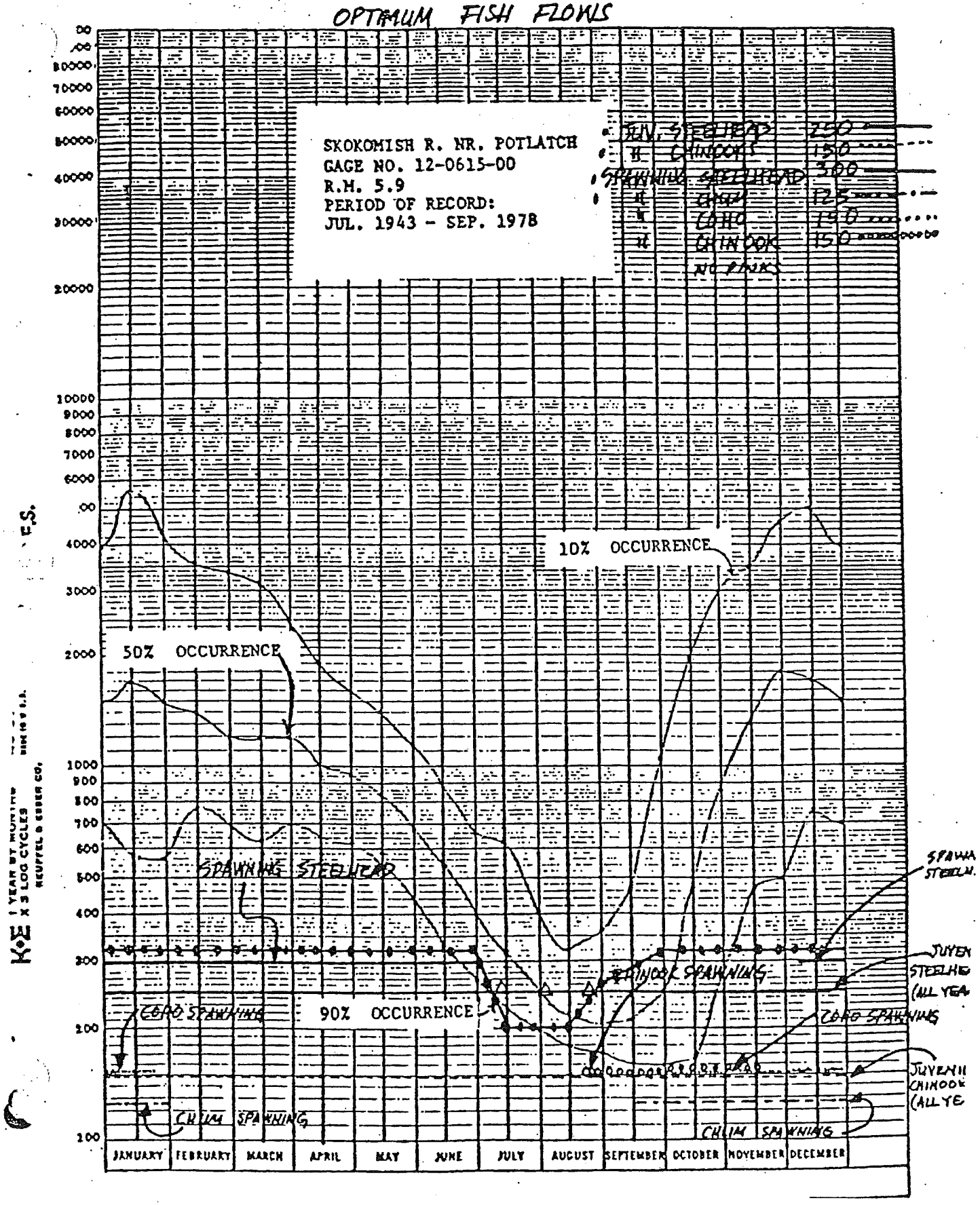
JORSTED CREEK NR. HWY. 101
GAGE # WDOE-0552-00
R.M. 0.1
CORRELATED TO:
JEFFERSON CREEK NR. ELDON
GAGE # 12-0546-00
R.M. 0.2
PERIOD OF RECORD:
OCT. 1957-JUN. 1971



K·E 1 YEAR BY MONTHS X 3 LOG CYCLES KEUFFEL & ESSER CO. 46 6640

OPTIMUM FISH FLOWS




OPTIMUM FISH FLOWS
SKOKOMISH R. NR. POTLATCH
GAGE NO. 12-0615-00
R.M. 5.9
PERIOD OF RECORD:
JUL. 1943 - SEP. 1978
JUV. STEELHEAD 250
" CHINOOK 150
SPAWNING STEELHEAD 300
" COHO 125
" CHINOOK 150
NO PINKS
10% OCCURRENCE
50% OCCURRENCE
90% OCCURRENCE
SPAWNING STEELHEAD
COHO SPAWNING
CHUM SPAWNING
CHINOOK SPAWNING
SPAWN STEELH.
JUVEN STEELHD (ALL YEA
COHO SPAWNING
JUVENIL CHINOOK (ALL YE
CHUM SPAWNING
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER

OPTIMUM FISH FLOWS