

State of
Washington
Department
of Ecology



WATER RESOURCES MANAGEMENT PROGRAM



Whatcom Creek Basin Study
WRIA I
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Introduction

This study reconstitutes the natural flow in Whatcom Creek, and sets forth information on consumptive use of its water. Secondly, it examines the difficulties experienced pertaining to the issue of water rights in the area.

Background

The City of Bellingham claims ownership of all available water in Lake Whatcom. In the past, the city has protested the issuance of water rights to others for Lake Whatcom water. The city has shown a desire to sell water to Water District #10 on a long-term agreement, but does not want them taking water from Lake Whatcom without compensation.

The basin includes part of the City of Bellingham; additionally, it spreads out in a southeasterly direction covering an area of 65 square miles. Lake Whatcom lies in the center of this basin, with several small creeks flowing into it. Water flows from Lake Whatcom through Whatcom Creek to the Puget Sound. A court ordered maximum and minimum elevation of 314.94 feet and 310.94 feet respectively, allow for approximately 20,000 acre-feet of storage. The surface area of Lake Whatcom is 5,003 acres.

The City of Bellingham is the principal water user in the basin with a water right claim for 82 mgd (127 cfs) from Lake Whatcom, and a Certificate of Water Right for 20,000 acre-feet of storage in Lake Whatcom. Since 1962 the City of Bellingham has diverted up to 125 cfs into Lake Whatcom from the Middle Fork of the Nooksack River. Whatcom County Water District #10 is the next largest water user; it supplies the Sudden Valley development from Lake Whatcom. There are also many single domestic users in the basin.

Basin Study

To determine the natural productivity of the basin, Whatcom Creek was deregulated. The data from two periods of record, October 1945 to September 1956 and December 1967 to September 1969, were used. The information used was: (1) recorded flows in Whatcom Creek; (2) Bellingham's records of municipal and industrial (M&I) withdrawals from Lake Whatcom; (3) the changes in storage in Lake Whatcom; and (4) Bellingham's inter-basin transfer of water to Lake Whatcom from the Middle Fork of the Nooksack River. There are two USGS gages on Whatcom Creek that supply data on the actual flows. For purposes of this study, gage #12-2035-00 in Whatcom Creek below the fish hatchery was used. The fish hatchery's diversion from Lake Whatcom was ignored since the water diverted for hatchery use is put back into the creek upstream of this gage. The City of Bellingham has supplied the information on their (M&I) withdrawal, the changes in storage in Lake Whatcom, and their diversions of water from the Middle Fork of the Nooksack to the Whatcom Basin. Monthly values were used for all calculations because Bellingham's M&I use is available in monthly values only.

Whatcom Creek Deregulation

The first step in deregulating Whatcom Creek is to record the mean monthly flows from USGS gage #12-2035-00 for each month of the two periods used. These flows were taken from Water Resources Data for Washington, Part 1, Surface Water Records, prepared by the United States Geological Survey.

The second step is to add the monthly quantities of water taken from Lake Whatcom by Bellingham for its M&I supply to the recorded mean monthly flows in the creek. In doing so, it was assumed water taken by Bellingham would have normally flowed through Whatcom Creek. Thus, by adding the amount taken from the lake, Whatcom Creek is deregulated with respect to Bellingham's withdrawal.

The third step in deregulating is to adjust for changes in storage in Lake Whatcom. It was assumed that any increase in storage represents water that would have flowed down Whatcom Creek. Thus, for months where the lake elevation increased, the increased storage (in cfs-month), was added to the flow in the creek. Conversely, for months when the lake elevation decreased, the decrease in storage was subtracted from the flow in the creek. The assumption is that by decreasing storage, extra water is being released down the creek that would not have been there under natural conditions.

The fourth, and final step in deregulating Whatcom Creek is to correct for water coming from the Middle Fork of the Nooksack River. At certain times of the year, Bellingham diverts 125 cfs from the Middle Fork of the Nooksack River via pipe, tunnel, lake, and creek to Lake Whatcom. This quantity is subtracted from the flow in Whatcom Creek since it is an unnatural addition to the basin. The diversion works were first used in 1962. The period from 1967 to 1969 is the only one where the Middle Fork diversions need to be included in the deregulation calculations. The period from 1945 to 1956 is before the diversion on the Middle Fork was built. In deregulating this time period, we are not concerned with the Middle Fork.

Once the deregulated monthly flows were calculated, an exceedence graph was produced for the entire year, assuming a normal distribution. Tables 1 and 2 show the productivity of Whatcom Creek Basin for 1 in 2 and 9 in 10 year occurrences. Table 3 shows the flows exceeded various percentages of the time for each month. Table 4 shows the deregulated monthly flows in Whatcom Creek from October 1945 to September 1956 and December 1967 to September 1969 at gage #12-2035-00. Table 5 shows the gaged monthly flows in Whatcom Creek at gage #12-2035-00 for the above period of record. Table 6 shows Bellingham's water use in cfs-month from 1969 through 1979. Figures 1 and 2 are hydrographs showing deregulated and gaged flows, respectively, at gage #12-2035-00.

Conclusion

From this study, it appears that this basin can, under natural conditions, yield annually 75,000 acre-feet in one out of two years and 21,000 acre-feet in nine out of ten years. Bellingham's Water Right Claim is for 92,000 acre-feet annually, although actual use appears to

*draft dated 6/17/80
has base flow language*
*Mr. Higgins memo 7/80
water reserved refers to block of*

be approximately 70,000 acre-feet annually. Because of the court ordered elevation limits for Lake Whatcom, approximately 13,000 acre-feet of the 75,000 acre-foot yield in a one out of two year flow is released down Whatcom Creek. The Middle Fork of the Nooksack River will supply the difference between Bellingham's needs and the annual runoff into Lake Whatcom.

Table 1 - Whatcom Creek Basin Flow and Use Information for
1 out of 2 Year Flows*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total (acre-feet)
Water in Whatcom Creek 1 out of 2 (1) years (cfs-month)	280	290	220	150	65	30	6	7	12	85	210	280	99,000 <i>(avg)</i>
	<i>267</i>	<i>280</i>	<i>196</i>	<i>128</i>	<i>61</i>	<i>31</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>78</i>	<i>216</i>	<i>297</i>	<i>p = m/n</i>
Bellingham's Approximate M&I (2)** Demand (cfs-month)	84	82	86	89	93	97	97	105	91	87	87	81	65,000
Difference between available water & (3) Bellingham's demand (1)-(2)=(3)													
(cfs-month)	196	208	134	61	-28	-67	-91	-98	-79	-2	123	199	
(acre-feet)	12,050	11,650	8,240	3,630	-1,720	-3,980	-5,590	-6,020	-4,700	-120	7,320	12,230	

51,490 ac-ft Possible addition to storage from November through March (20,000 ac-ft is max. storage)
 20,000 ac-ft Storage - beginning of May
-22,130 ac-ft Required water to supply Bellingham May through October
 - 2,130 ac-ft Excess of Whatcom Creek Basin productivity needed by City of Bellingham (diversion from
 Middle Fork of the Nooksack River supplies the extra water)

*Based on the period of record: Oct. 1945-Sept. 1956 and Oct. 1967-Sept. 1969.

**Based on city records for the period 1969 through 1979 (Table 6).

51,490
 20,000
31,490
29,000
 7,590

Table 2 - Whatcom Creek Basin Flow and Use Information for
9 out of 10 Year Flows*

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total (acre-feet)
Water in Whatcom Creek 9 out of 10 (1) years (cfs-month)	150	155	110	65	20	2	0	0	0	8	60	125	42,000
	-1	-13	+4	+6	-2	+2	±	±	±	+1	-3	-2	
Bellingham's Approximate M&I (2)** Demand (cfs-month)	84	82	86	89	93	97	97	105	91	87	87	81	65,000
Difference between available water & (3) Bellingham's demand (1)-(2)=(3)													
(cfs-month)	66	73	24	-24	-73	-95	-97	-105	-91	-79	-27	44	
(acre-feet)	4,060	4,080	1,470	-1,430	-4,490	-5,650	-5,960	-6,450	-5,410	-4,860	-1,610	2,700	

10,700 ac-ft Possible addition to storage from November through March (20,000 ac-ft is max. storage)
 9,270 ac-ft Storage - beginning of May
 -32,820 ac-ft Required water to supply Bellingham May through October
 -23,550 ac-ft Excess of Whatcom Creek Basin productivity needed by City of Bellingham (diversion from
 Middle Fork of the Nooksack River supplies the extra water)

*Based on the period of record: Oct. 1945-Sept. 1956 and Oct. 1967-Sept. 1969.

**Based on city records for the period 1969 through 1979 (Table 6).

$$f = \frac{m}{n+1}$$

Table 3. Exceeded Flows for Whatcom Creek (Deregulated)*

% of Time These Flows are Exceeded	Flows in cfs											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
99	45	60	5	5	0	0	0	0	0	0	0	0
95	114	130	67	48	10	0	0	0	0	0	21	75
90	151	168	106	71	22	0	0	0	0	7	63	127
80	196	213	140	99	37	9	0	0	0	33	113	189
70	229	245	168	119	47	17	0	1	1	53	150	235
60	256	273	193	136	56	23	2	4	4	69	181	273
50	282	299	216	152	64	30	5	7	8	85	210	309
40	308	325	239	168	72	36	7	9	11	100	239	346
30	335	353	263	185	81	43	10	12	15	117	270	384
20	368	385	292	205	92	51	14	16	19	136	306	429
10	413	430	332	232	106	62	19	21	25	163	356	492
1	519	537	427	298	140	88	30	33	39	226	476	641

*Based on the period of record: Oct. 1945-Sept. 1956 and Oct. 1967-Sept. 1969.

Table 4. Deregulated Flows in Whatcom Creek at
Gage Number 12-2035-00

	31 JAN	29.25 FEB	31 MAR	30 APR	31 MAY	30 JUN	31 JUL	31 AUG	30 SEP	31 OCT	30 NOV	31 DEC
1945										215	338 ³	218
1946	305 ⁶	288 ⁶	280 ³	229 ² /	39	40 ⁵	0	0	0	27 /	78 ¹¹	256
1947	353 ⁴	255	146	128	27	23 ⁷	0	0	0	137	172 ⁸	287 ⁷
1948	238 ⁹	258	164	95	126 ¹	31 ⁸	0	19	14	67	347 ²	274
1949	94 ¹³	438 ³	252 ⁴	119	40	7	6	4	8	40	203 ⁷	638 ¹
1950	191 ¹²	441 ²	446 ¹	281 ¹	71 ⁴	5	0	3	0	97	229 ⁶	375 ³
1951	371 ³	491 ¹	199 ¹⁰	44	61 ⁷	0	0	0	0	44	98 ¹⁰	195
1952	201 ¹⁴	211	156	119	86 ²	8	0	0	0	0	0 ¹²	49
1953	481 ¹	280 ⁷	185	136 ⁶	66 ⁸	32 ⁶	0	0	0	92	252 ⁵	461 ²
1954	393 ²	345 ⁴	108	111	45	58 ³	14	33	15	41	303 ⁴	220
1955	238 ⁹	291 ⁵	196	214 ³	125 ²	63 ¹	39	3	0	107	348 ¹	373 ²
1956	317 ³	155	316 ²	155 ⁵	22	71 ¹	0	0	18			
1967												363 ⁵
1968	220 ¹⁰	242	220 ²	150	70 ⁴	48 ⁴	0	24	47	148	147 ⁹	313 ⁶
1969	263 ⁷	191	139	191 ⁴	56	0	0	0	0			

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Table 5

Gaged Flows in Whatcom Creek at
Gage Number 12-2035-00

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1945										38	342	176
1946	317	254	158	199	6	6	5	5	6	4	50	258
1947	211	219	121	52	21	7	7	7	5	68	140	170
1948	214	164	175	38	10	18	7	7	5	6	208	344
1949	36	326	250	6	18	6	7	7	6	6	51	469
1950	333	338	437	191	11	5	4	6	5	5	9	268
1951	357	387	104	7	8	6	6	5	4	6	5	7
1952	7	115	90	71	37	10	9	9	7	6	4	2
1953	6	180	112	58	13	11	12	10	7	5	8	419
1954	325	226	14	9	8	8	7	4	3	2	6	24
1955	212	261	17	134	17	15	11	10	7	6	33	397
1956	229	20	199	89	11	8	7	6	5			
1967												183
1968	223	136	98	60	9	9	7	7	7	12	128	283
1969	153	22	48	96	44	8	6	7	7			

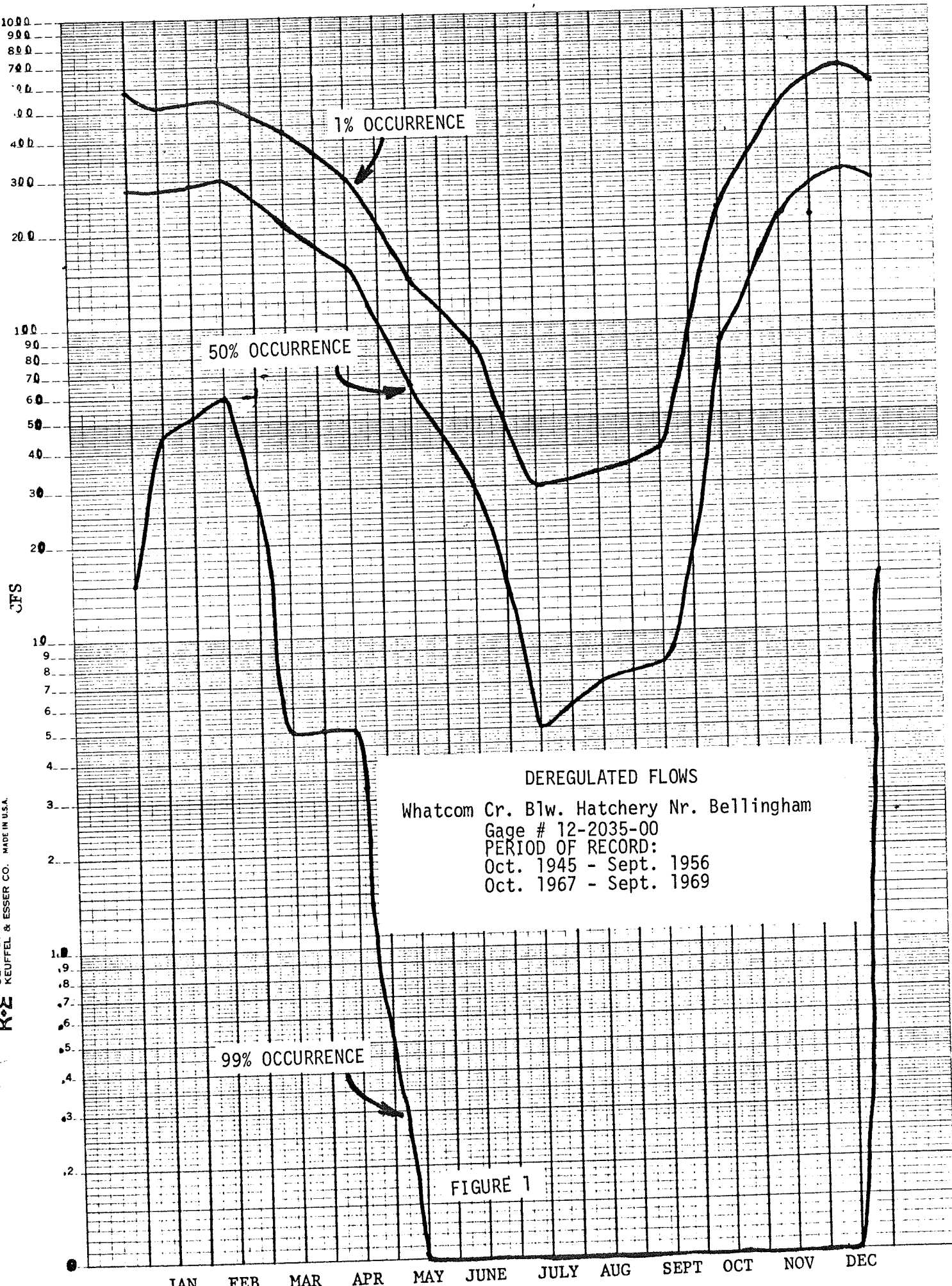
Table 6

City of Bellingham's Water Usage
(CFS - Month)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1969	98	92	91	92	93	109	98	99	90	89	90	80
1970	88	88	87	89	92	93	109	106	98	102	104	93
1971	92	88	80	80	94	90	98	112	81	91	87	84
1972	89	89	86	88	92	102	83	105	90	89	91	86
1973	88	90	89	93	95	107	110	113	101	99	95	91
1974	93	87	92	97	98	104	102	119	104	101	92	91
1975	93	89	88	88	93	89	99	101	88	91	88	84
1976	86	86	82	85	88	89	96	93	90	89	87	86
1977	87	87	87	90	89	93	101	113	92	89	88	87
1978	88	89	87	86	91	94	69	85	71	34	45	30
1979	27	18	77	93	96	100	102	104	94	88	89	81
11-Year average	84	82	86	89	93	97	97	105	91	87	87	81

46 6010

SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.



DEREGULATED FLOWS
Whatcom Cr. Blw. Hatchery Nr. Bellingham
Gage # 12-2035-00
PERIOD OF RECORD:
Oct. 1945 - Sept. 1956
Oct. 1967 - Sept. 1969

FIGURE 1

46 6010

SEMI-LOGARITHMIC 4 CYCLES X 70 DIVISIONS
KEUFFEL & ESSER CO. MADE IN U.S.A.

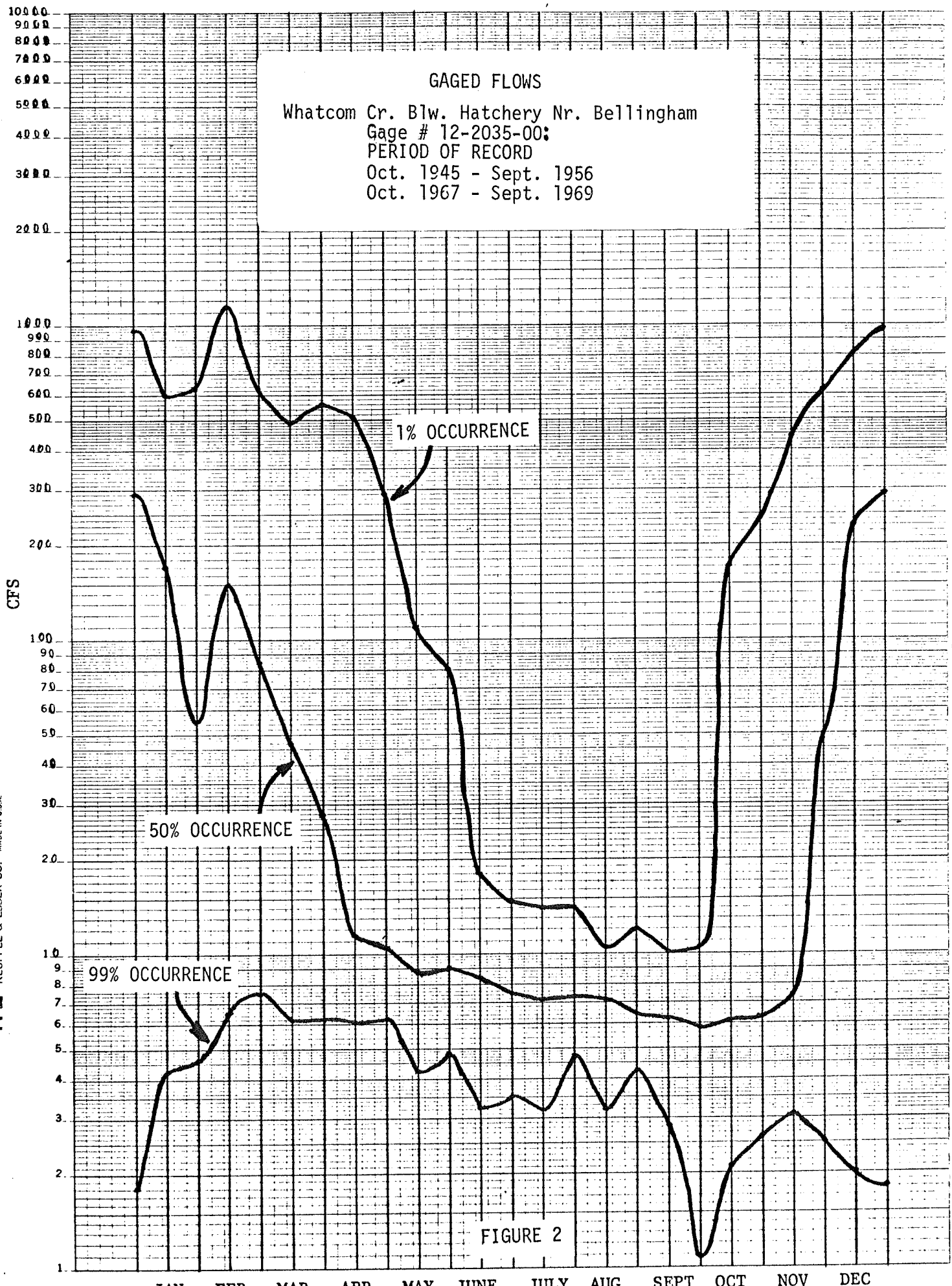


FIGURE 2