

MEMORANDUM

June 24, 1975

To: Dick Cunningham  
From:  Roger Stanley/Greg Cloud  
Subject: Baker Lake Survey

The Department of Ecology's Water Monitoring Section conducted a short receiving water survey of Baker Lake on June 16 and 17, 1975. This study was the result of a recent request by DOE's Northwest Regional Office and was prompted by increasing interest in Mount Baker's volcanic activity and reported low hydrogen ion concentrations (pH) in one of its drainages (Boulder Creek). This fair-sized glacial stream, drains a substantial portion of the mountain's eastern flank and eventually enters Baker Lake midway along its western shore. The survey's goals were to first verify the acidic condition of Boulder Creek and second, to determine to what extent this stream is affecting the quality of Baker Lake itself.

A total of five transects of the lake were conducted along with miscellaneous measurements in major feeder streams along the lake's western shoreline. Three of the above transects originated at the mouth of Boulder Creek and proceeded across the lake to its eastern shore. This portion of the study provided insight into the location and extent of Boulder Creek's plume. Visual observation of the glacially-floured creek water was also helpful in this respect. The remaining two transects revealed conditions at the lake's northern and southern ends (see attached map for transect locations).

Results

Hydrogen ion concentrations within Boulder Creek itself were indeed very low. Obtained pH values ranged from 3.8 - 4.4 (other similar nearby streams were near 7.0). Past research has revealed pH levels of less than 4.5 to be nearly always toxic to salmonid fishes. These acid waters were, however, buffered to near Baker Lake's natural pH condition fairly rapidly. It appeared that the actual affected area of the lake was rather small and ran approximately 75 yards north of the creek's mouth, 150 yards south, and roughly 100 yards east to near the middle of the lake. It should here be noted that at the time of the study Baker Lake was in a drawn down condition and was considerably lower (narrower) than

is shown on the attached map. Boulder Creek's plume of cold, acidic water largely sank to the bottom of the lake as it spread eastward from the mouth. pH values were consequently lowest within these deeper waters of the affected area. Hydrogen ion concentrations noted within the lake's upper waters near the creek mouth were generally lowered only a few tenths below natural conditions measured within the unaffected area of the lake along transect 4. Other study parameters observed during the course of the survey (temperature, dissolved oxygen, conductivity and total sulfides) revealed no significant water quality problems.

It has recently been suggested that DOE's Water Monitoring Section establish a permanent sampling station on Baker Lake in order to "keep tabs" on future developments in water quality with regards to Mount Baker's activity and Boulder Creek, specifically. It is hereby recommended that this station should be established and that its location be 250 feet west of the eastern shoreline, directly opposite the mouth of Boulder Creek (on Transect 1 of the attached map). However, at the present time there is insufficient evidence of lake water quality degradation to warrant a high sampling frequency and it is therefore recommended that this site be visited occasionally on a spot check basis, possibly every other month.

RFS:ee

cc: Glen Fiedler  
Duane Wegner  
Ron Pine

Table 1: Water Quality Data Collected During Baker Lake Survey of June 16 and 17, 1975

Transect #1: Run from the Mouth of Boulder Creek Directly across the Lake to the Eastern Shore

Station #	Location	Parameter*			
		Depth(ft)	Temperature(°C)	Dissolved Oxygen(mg/l)	pH(SU)
1.	Mouth	0	12.0	11.0	5.5
2.	Mouth + 50' (Bottom @ 5')	0	12.0	10.8	6.0
		5	9.6	11.4	5.3
3.	Mouth + 100' (Bottom @ 10')	0	12.0	11.2	6.4
		5	12.0	11.2	6.4
		10	11.8	11.0	6.2
4.	Mid Lake (Bottom @ 35')	0	12.6	10.8	6.6
		5	12.5	10.8	6.6
		10	12.3	10.8	6.6
		25	11.5	10.8	6.2
		30	11.0	3.6**	6.3
5.	Bisect of 4 & 6 (Bottom @ 45')	0	12.5	10.8	6.6
		5	12.5	10.8	6.7
		10	12.5	10.6	6.7
		30	11.3	3.1**	6.7
		45	9.5	11.0	6.5
6.	East Shore (Bottom @ 50')	0	12.7	10.9	6.8
		5	12.6	10.6	6.8
		10	12.6	10.6	6.8
		30	11.7	10.5	6.7
		50	8.8	11.1	6.9

Table 1 (Continued)

Transect #2: Run from the Mouth of Boulder Creek in a Northeast  
Direction to the Eastern Shore (Roughly N 60° E)

Sta. #	Location	Parameter*			
		Depth	Temp	D. O.	pH
1.	No. edge of mouth in plume	0	8.1	7.2	4.2
2.	50' off Sta. 1 (bottom @ 7')	0	12.0	11.0	6.3
		5	11.5	10.6	5.7
3.	100' off Sta. 1 (bottom @ 11')	0	12.1	10.8	6.5
		5	12.0	10.7	6.5
		10	10.6	10.9	6.5
4.	Mid Lake (Bottom @ 33')	0	12.4	11.0	6.6
		5	12.4	10.7	6.6
		10	12.0	10.6	6.7
		30	10.5	11.0	6.4
5.	Bisect of 4 & 6 (Bottom @ 38')	0	12.7	10.8	6.7
		5	12.6	10.6	6.7
		10	12.3	10.8	6.7
		30	10.4	10.9	6.8
6.	East Shore (Bottom @ 40')	0	12.5	10.6	6.8
		5	12.6	10.6	6.8
		10	12.5	10.7	6.8
		30	9.7	10.8	6.9
		40	9.0	11.1	6.9

Table 1 (Continued)

Transect #3: Run from the Mouth of Boulder Creek in a Southeast  
Direction to the Eastern Shore (Roughly S 120 E)

Sta. #	Location	Parameter			
		<u>Depth</u>	<u>Temp</u>	<u>D. O.</u>	<u>pH</u>
1.	So. edge of mouth	0	12.0	10.8	6.8
2.	50' off Sta. 1  (Bottom @ 12')	0	12.0	10.8	6.6
		5	12.0	10.8	6.6
		10	11.9	10.7	6.5
3.	100' off Sta. 1  (Bottom @ 30')	0	12.0	10.9	6.6
		5	12.0	10.8	6.6
		10	12.0	10.6	6.6
		30	11.2	10.8	6.2
4.	Mid Lake  (Bottom @ 40')	0	12.2	10.8	6.7
		5	12.2	10.7	6.7
		10	12.3	11.0	6.7
		30	10.7	11.0	6.5
		40	9.7	10.8	6.5
5.	Bisect of 4 & 6  (Bottom @ 53')	0	12.7	11.0	6.8
		5	12.7	10.8	6.9
		10	12.3	10.8	6.9
		30	10.6	10.8	6.7
		50	9.0	11.2	6.7
6.	East Shore  (Bottom @ 54')	0	12.7	11.0	7.0
		5	12.6	10.8	6.9
		10	12.3	11.1	6.8
		30	10.5	10.9	6.9
		50	9.0	11.1	7.0

Table 1 (Continued)

Transect # 4: Run on Upper Baker Lake near Northern End from  
Campground on North Side of Lake to Major Point at  
Noisy Creek (Roughly S 180°)

Sta. #	Location	Parameter			
		<u>Depth</u>	<u>Temp</u>	<u>D. O.</u>	<u>pH</u>
1.	North Shore  (Bottom @ 11')	0	9.6	12.4	7.2
		5	9.5	12.1	6.9
		10	7.6	12.5	6.7
2.	Mid Lake  (Bottom @ 20')	0	9.6	12.6	6.9
		5	9.5	12.8	6.7
		10	9.4	12.4	6.8
3.	South Shore  (Bottom @ 12')	0	10.5	12.6	6.9
		5	9.7	12.4	6.8
		10	9.5	12.3	6.8

Transect #5: Run West to East on the Lower Reservoir Along the  
Section Line between Sections 20 and 29

Sta. #	Location	Parameter			
		<u>Depth</u>	<u>Temp</u>	<u>D. O.</u>	<u>pH</u>
1.	1/3 across lake from west shore  (Bottom unknown)	0	11.8	11.7	7.0
		5	11.6	12.0	6.9
		10	11.5	11.8	6.8
		30	10.7	12.0	6.7
		50	10.2	12.0	6.7
		100	9.3	6.5***	6.7
2.	2/3 across lake from west shore  (Bottom unknown)	0	12.1	12.2	6.8
		5	12.0	11.4	6.8
		10	11.8	11.4	6.8
		30	10.7	12.1	6.6
		50	10.1	12.0	6.7
		100	9.3	12.0	6.6

\* Spot checks on conductivity and total sulfides revealed no abnormalities

\*\* Unexplained "pocket" of low oxygen content

\*\*\* Erratic meter reading

Table 2: Miscellaneous Measurements Taken on Major Feeder Streams to Baker Lake (Approximately 100' Upstream from Mouths)

Sta.	Stream	Temperature	Dissolved Oxygen	pH
A	Boulder Creek	8.6	Not taken	3.8
B	Big Sandy Creek	6.2	13.3	7.3
C	Park Creek	6.3	13.6	7.1
D	Swift Creek	5.6	13.8	7.1



Schematic of June 16 & 17 Baker Lake survey showing major feeder streams, study transects ( - - - ), pH effected area (  ), and visually glacial (milky) portion of the lake (  )