

Memorandum

To : Warden Walter D. Choate

Date: November 1, 1968

From : Department of Fish and Game

Subject: Big Sulphur Creek, Sonoma County

On October 2, 1968, I checked Big Sulphur Creek at four established stations between The Geysers and the confluence with Squaw Creek. The stations were:

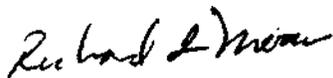
Station 1a - Big Sulphur Creek, 300 feet upstream from P G & E Bridge at The Geysers.

Station 2a - Big Sulphur Creek at footbridge crossing stream at The Geysers Mineral Bath House.

Station 3a - Big Sulphur Creek, 300 feet downstream from P G & E Units 3 and 4 waste discharges.

Station 4a - Big Sulphur Creek under bridge about 100 feet upstream from confluence with Squaw Creek.

Data was gathered at all four stations. Three Surber samples of stream bottom life were obtained at all four stations. Stream bottom materials were sampled at stations two, three and four. The data is presented in Table I, II, III and IV.



Richard L. Moore
Asst. Water Quality Biologist
Region 3.

cc: Mr. Don Lollock
~~Capt.~~ Insp. Ellis O. Berry
Capt. Glenn Whitesell.

BIG SULPHUR CREEK

Stream Bottom Organisms¹

	Station 1	Station 2	Station 3	Station 4
Stoneflies	4	1	0	0
Mayflies	51	0	0	0
Caddis flies (net builders)	225	140	0	1
(case builders)	25	8	0	0
True flies (Diptera)	9	2	1	275
Water Beetles	200	0	0	0
True Beetles	20	1	0	0
Snails	**	***	0	*
Other	4	0	0	0
Volume in ml.	2 ml.	3.6	Trace	2.6

¹ Numbers represent the average of three combined Surber samples at each station. * 0 to 10; ** 100 - 200; *** 200 or more.
[not included in volumetric measurement.]

As noted in Table 1, mayflies and stoneflies are absent from the two downstream stations where thermal waste discharge and silt discharge has entered the stream. Mayflies are absent and stoneflies are very scarce at Station 2 downstream from both natural and developed thermal discharge.

As noted in Table I, Station I, upstream from the major geothermal and silt discharges, all of the important aquatic insect orders are represented by at least one species, while at Station 2 downstream from both natural and developed geothermal discharges the number and variation in insects decreases. At Station 3 downstream from both P G & E Geothermal Units 3 and 4 and the Union Oil Company road building activities, only one fly larvae was found in three Surber samples. This specimen was in the process of pupation and may have drifted into the sample from upstream. Otherwise, no living organism was found at this location. At Station 4, the large numbers of "true flies" in this area were black flies (simuliids). This indicates the area was still not being utilized by predatory fish.

The composition of the stream bottom samples is presented in Tables II, III and IV. The bottom samples were strained through several screens of various sizes as indicated in Table II. The material was then measured by displacement of water. The volume in milliliters is presented in Table II; the volume by percent is indicated in Table III and the percent spawning gravel and deleterious silt is summarized in Table IV.

TABLE II
BIG SULPHUR CREEK
Gravel Samples

Particles Size in inches	Volume in ml			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
3 or more	-	290	0	160
1 to 3	-	5,180	2,380	5,400
0.5 to 1	-	4,600	2,880	4,490
0.125 to 0.5	-	6,710	6,030	6,790
0.046 to 0.125	-	2,230	3,270	3,000
0.039 to 0.046	-	390	510	500
0.0232 to 0.039	-	640	1,420	770
0.0035 to 0.0232	-	900	4,300	730
Smaller than 0.0035	-	3,768	5,150	1,458
Total		24,708	25,940	23,298

TABLE III
BIG SULPHUR CREEK
Gravel Samples

Particle Size in Inches	Volume by (%) Percent			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
3 or more	-	1.2	0.0	0.7
1 to . 3	-	21.0	9.2	23.2
0.5 to 1	-	18.2	11.1	19.3
0.125 to 0.5	-	27.2	23.2	29.0
0.046 to 0.125	-	9.1	12.6	12.9
0.039 to 0.046	-	1.6	2.0	2.1
0.0232 to 0.039	-	2.6	5.5	3.3
0.0035 to 0.0232	-	3.7	16.8	3.1
Smaller than 0.0035	-	15.4	19.9	6.4
Total	-	100.0	100.3	100.1

TABLE IV
BIG SULPHUR CREEK

Stream bottom Material	Volume by Percent			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Spawning Gravel (0.5 inches or longer [larger])		22.2	9.2	23.9
Intermediate (0.039 to 0.5)	-	56.1	49.1	63.3
Deleterious Silt	-	21.7	41.7	12.8

In all three samples about 1/2 of the material is of intermediate size being neither large enough for spawning gravel or small enough to be deleterious to spawning. (See Table IV). About half of this material is large enough to be used for spawning by small trout. (See Table III, size 0.125 to 0.5 inches).

The amount of spawning gravel at the three stations indicates 20 to 25 percent good gravel in stream stations, subject to some siltation as in Station 2 and Station 4. At Station 3, which has undergone recent siltation during a period of low stream flow, stream bottom material has been replaced by silt, which makes up over 40 percent of the material.

Station 2 has recently undergone moderate siltation from Union Oil Co. road construction upstream near Station 1. The effect can be seen in the percent of silt at Station 2 in Table IV.

In Big Sulphur Creek, natural stream turbidity is largely limited to those periods when storm waters cause erosion. During these periods, stream flows in areas suitable for steelhead, trout or salmon-spawning are sufficient to prevent bottom deposits of natural erosion silt and damage to eggs in the gravel is minimal. Damage to the spawning gravel occurs when silt enters the stream at times other than storm periods when the water velocity is insufficient to carry the sediment in suspension. It is a well-known fact that the velocities necessary to dislodge deposited particles are far greater than the velocities required to carry the same particles in suspension. Thus, depositing silt in streams such as Big Sulphur Creek during non-erosion periods results in bottom deposition in the spawning gravel which is unnatural and extremely detrimental to the fishery.

The streams appeared relatively clear on this date except at Station 3 downstream from the silt entering the stream from the Union Oil Company road-~~building~~[repairing] activity. The turbidity in this area was milk chocolate in color and the clarity of water was only a measured 3 inches. Upstream from this area the bottom was clearly visible at a depth in excess of 3 feet.

The silt and larger material from the Union Oil Co. road formed a delta across the stream, backing up the water and forming a pool in excess of three feet in length. Silt was carried downstream and deposited in the streambed covering the entire wetted areas. On this date, the water had eroded a channel in the silt and this channel carried the entire flow leaving the former wetted area silted and without flowing water. The rubble and boulders were covered with silt ~~with~~ leaving only the upper portion of the boulders appearing above the silt.

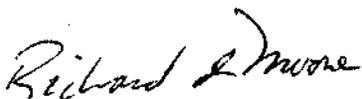
The silt at Station 3 is from 1/2 to two feet in depth in the center of the streambed. The silt extends downstream an undetermined distance. No resident aquatic organisms were observed in this area.

Pictures were obtained of this area to compare with pictures taken prior to siltation. These pictures along with the samples clearly indicate Union Oil Company is damaging the [trout] ~~front~~ fishery and are in violation of Section 5650 of the Fish and Game Code.

Pictures were also taken showing roadbuilding activity upstream from The Geysers area. Union Oil has begun construction of a road from The Geysers area to the Little Geysers upstream a distance of $3\frac{1}{2}$ miles. The road will be built on the steep north facing slope. Activity has resulted in silt entering the stream at Station 1 upstream from The Geysers. Silt has been side cast down the hillside and slides now extend $\frac{1}{2}$ the distance across the streambed. At Station I, the quiescent flow did not soil the waters and lower the visibility on this date, however, there was a layer of fine silt on the bottom downstream from this area. Almost all of this loose material will wash downstream during the first major storm of the season. This will add to the siltation of steelhead spawning gravel as well as deplete the fish food organisms. Plans are underway to sample the fish food organisms in the area following the first major storm of the season and compare the results with data collected in January of 1968.

The physical evidence, and the depletion of fish food organisms, indicate the Union Oil Company road-building activities at Station I upstream from The Geysers and at Station 3 downstream from the P G & E Geothermal waste discharge from Units 3 and 4, are deleterious to fishlife and, therefore, in violation of Section 5650 of the Fish and Game Code.

If you have any further questions or require further assistance on this matter, please let me know.



Richard Moore
Asst. Water Quality Biol.

November 1, 1968