State of California **The Resources Agency**

Memorandum

To : Files Date: May 20, 1976

From : Department of Fish and Game

Subject: Observations on tributaries to Big Sulphur Creek at the Geysers, Sonoma County.

The extent of natural geothermal emissions in the Geysers area has been a subject of controversy. During field trips on March 17, 1976, March 24, 1976, and April 1, 1976 information was collected on temperatures and NH_3 in tributaries of Big Sulphur Creek in the Geysers area, as follows:

1. March 17, 1976. Little Geysers Area. A hot pool, temperature above 130 F, was located in an area of fumarol soils. It did not discharge to any stream. The main stream from the fumarol area at the Little Geysers, discharging to Little Geysers Creek, had a temperature of 96 F in upper area. It passed through an area of fumarols, steaming and bubbling, and was 122 F below this area. A plastic pipe diverted part of the flow to a large hand-dug dirt-lined pool, in which the temperature was 110 F. The main flow continued on to Little Geyser Creek. Little Geyser Creek above this tributary was 58 F. The temperature of Little Geyser Creek was not measured below the tributary.

2. March 24, 1976. Big Sulphur Creek below tributaries C and D (as named by Parametrix, Inc. 1975., The Effects of Geothermal Energy Utilization on Stream Biota and Water Quality at The Geysers, California. Submitted to Union Oil Company, Los Angeles.).

   a. Big Sulphur Creek below tributary D (drains area of PG&E Units 3&4, Sulphur Bank area): 53 F, NH_3 at 2.6 ppm.
   b. Big Sulphur Greek below tributary C (just west of tributary D): right bank, 54 F, NH_3 at 3.0 ppm; left bank, 54 F, NH_3 at 2.3 ppm. Time 1200-1300. Tributary D apparently causes an increase in the temperature and NIL of Big Sulphur Creek. This tributary has fumarol activity in the area just below the Union Oil Co. road crossing.

3. March 24, 1976. Tributary F (named in Parametrix, Inc. report). This tributary has been recorded as having high temperature, acid water. It originates as a hot spring (temperature in excess of 120 F) just east of geothermal well GDC 53-13. After flowing about 70-80 feet, the temperature cools to 98 F. It then enters a fumarol area, and temperature increases to 106 F, then decreases just down-

stream to 98 F. It enters another fumarol area and temperature increases to in excess of 120 F. Just before it joins Big Sulphur Creek, the temperature is 75 F. Big Sulphur Greek above and below the mouth of this tributary is 54 F, so it had no effect on water temperature at the flows of this date. Time of observations 1430-1600.

4. April 1, 1976. Tributary E (named in Parametrix, Inc. report) enters Big Sulphur just west of tributary F. It forks near GDC 53-13, one fork coming from the Union Oil Co. Shop area and PG&E unit 5&6, and the other from the west of this area. Air temperature was 55 F at 0855. Temperature just before junction with Big Sulphur Creek was 65 F. The east fork had a temperature of 64 F above the junction with west fork. West fork temperature at junction was 68 F. The west fork originates on the hillside above, crosses under the road to GDC 53-13, flows through a small meadow, enters a fumarol area, and then joins with the east fork. Temperature above the fumarol area was 56 F, and 68 F below. One hot pool in the fumarol area had a surface temperature of 100 F, and 70 F at a depth of one inch. A hot spring with very small discharge was 103 F. Apparently the fumarol activity increases the stream temperature from 56 F to 68 F. The east fork also flows over some fumarols near the Union Oil Shop area, but temperatures were not measured here. Warm drainage from the base of Units 5&6 also contributes to flow of the east fork.

This information indicates that "natural" geothermal emissions may significantly affect temperatures, and other water quality characteristics, in tributaries to Big Sulphur Creek in the Geysers area. Whether or not these emissions are influenced by the operations, however, is unknown. For example, the hot springs and fumarols in tributaries E and F are adjacent to geothermal well GDC 53-13, and the origin of some of the flow of the east fork of tributary E is drainage from the base of the Unit 5&6 cooling tower basin, which may be leaking (the parking lot of Unit 5&6 partially slumped in 1973, requiring filling and compacting over an area of about 10 ft X 100 ft; a minor earthquake in 1974 caused cracks in the Union Oil Shop area concrete flooring).

The measurements also should be considered in view of diversions by PG&E and Union Oil Company on the subject tributaries. Such diversions are above the areas of apparent natural emissions, and tend to reduce the flows of the streams, resulting in increased effects from the emission sources because of a reduced dilution capability of the streams.

Maps indicating the sites of recordings are attached.

John Emig

John W. Emig
Associate Fishery Biologist
Region 3

JWE/gmc

Attachments

JOHN EMIG DEPT. FISH & GAME

Tenneys little Geysers area 3/17/76

Stream above fumarol area 58°F

discharge to L.G. Creek: Hot pool for bath 110°F

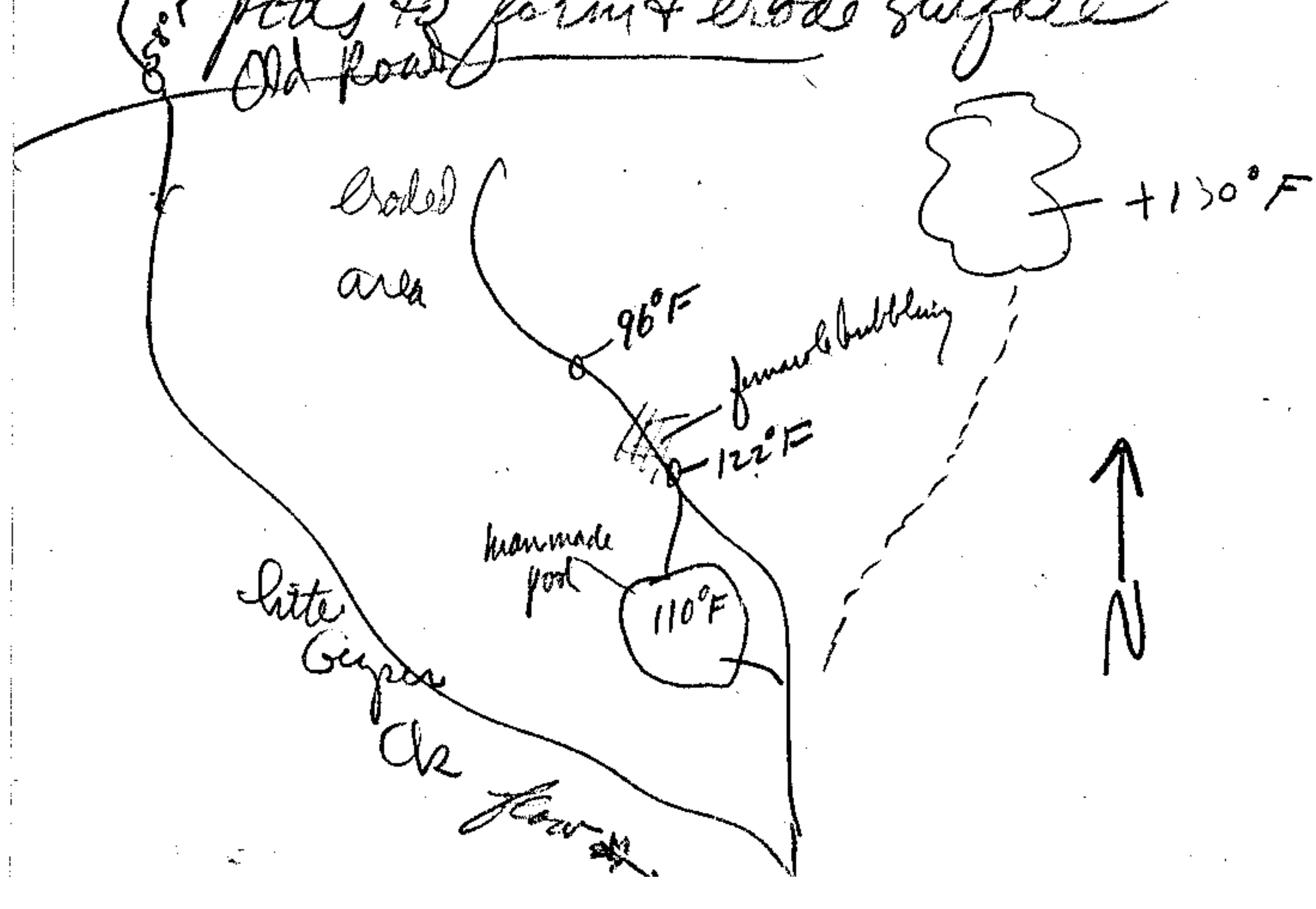
bubbling area above hot pool 122°F

area above bubbling 96°F

Boiling area on fumerol slope - over 130°F

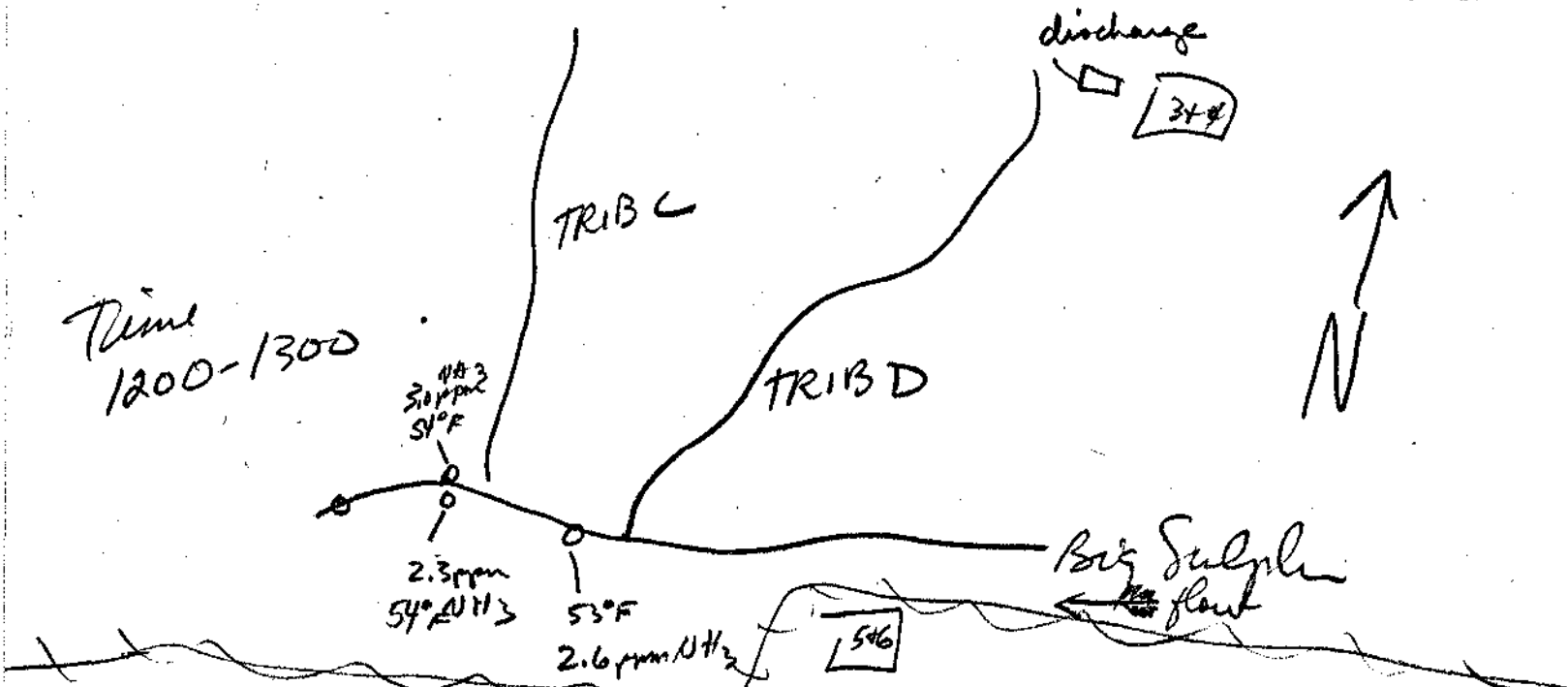
This has only minor discharge to L.G. creek

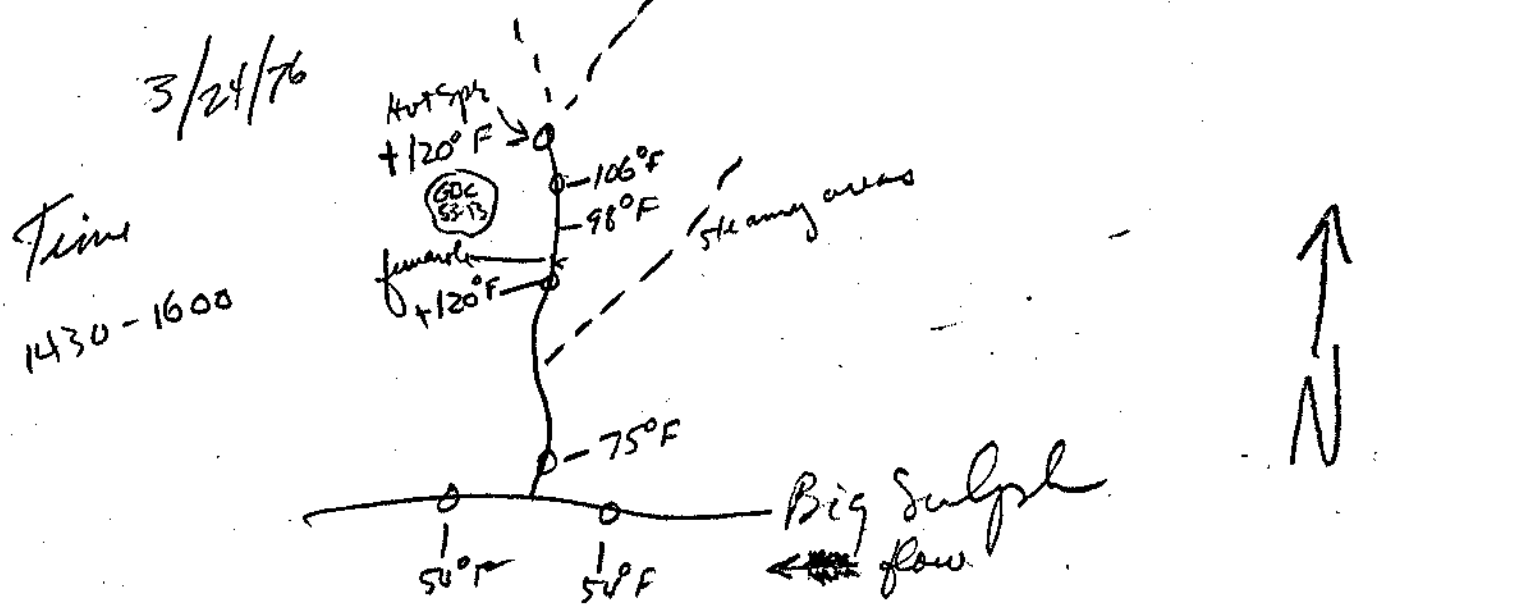
Area shows evidence of erosion from hot pools - suspect recent slippage of landslide opened up fissures & caused pools to form & erode surface



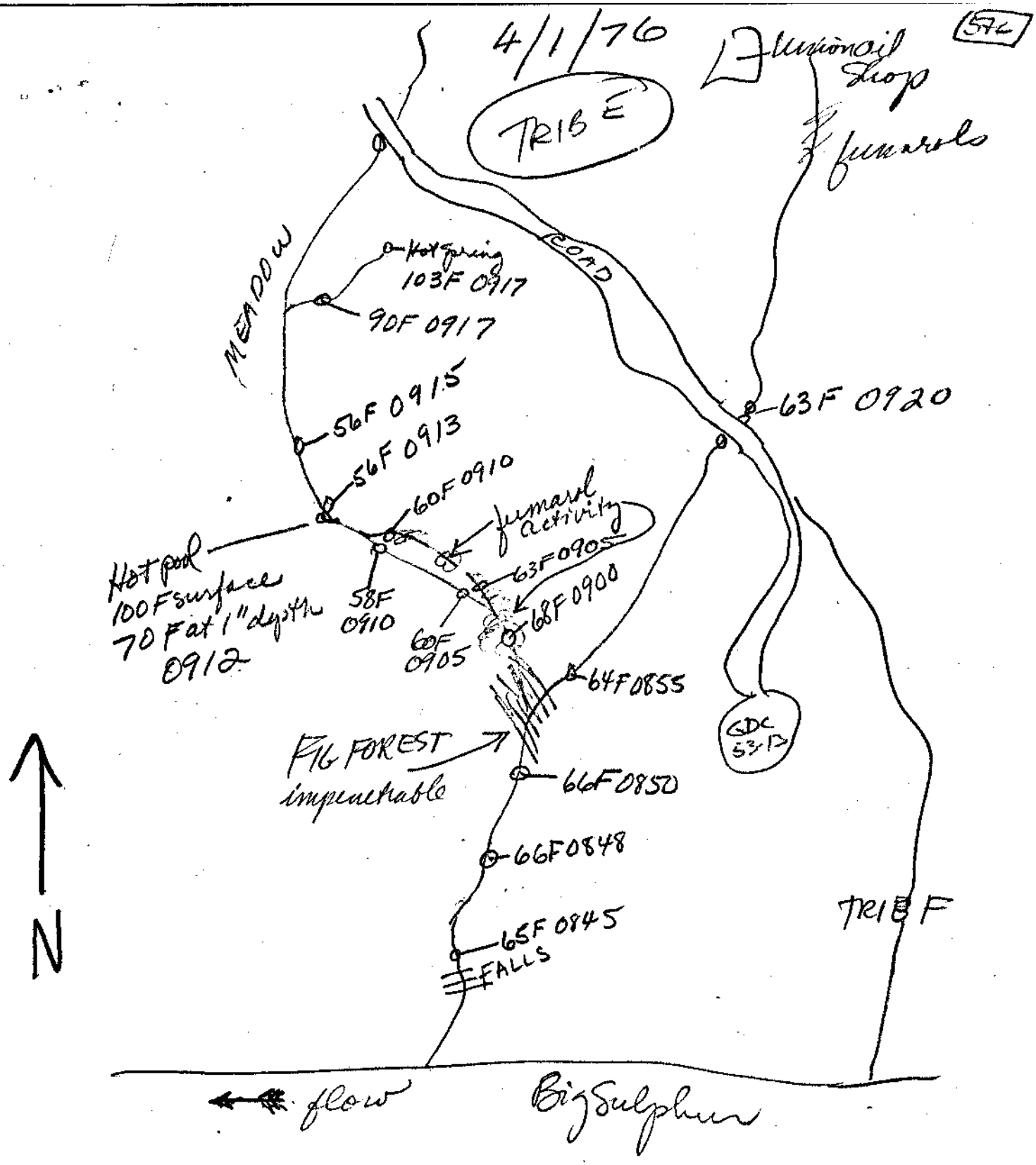
Field Notes 3/24/76

Trip w/ Jean St. + Connie R to tribs BSC





Trib. F



Air temp 55F 0855