UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

TEMPERATURE GRADIENTS IN HARNEY COUNTY, OREGON

By

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INTRODUCTION

As part of a brief reconnaissance of southeastern Oregon, temperatures were measured in five wells in the Harney Basin during May of 1972. The results are presented here together with a summary of temperature gradients previously published by Bowen (1972) and one well measured by C. E. Van Ostrand. Figures 1 and 2 show the location of the wells and the average temperature gradient in °C/km. Figures 3 through 7 show the temperature profiles measured by the U.S. Geological Survey.

PRELIMINARY INTERPRETATION

In the absence of suitable samples for the determination of thermal conductivity (or even of detailed drillers' logs) we can say little about the absolute value of heat flow. However, we note that the gradients are locally variable but mostly very high (typically 80 to 100 °C/km in sediments). This suggests a regional heat flux which is at least as high as the characteristic basin and range values ($\sim$ 2 μcal/cm^{2}sec) and could be double that amount.

The very high gradient of 60 °C/km in basaltic rocks in the Pueblo Mountains (figure 2 and Bowen, 1972) suggests a heat flow between 2.5 and 3.5 hfu.

Van Ostrand's gradient of 45°C/km (V1, figure 1) was measured below 1 km in what may be a quartz-rich sedimentary rock of quite high thermal conductivity. The gradient of 84°C/km in hole S1 was measured in very hard clays which could well have conductivities greater than 3 mcal/cm sec °C.

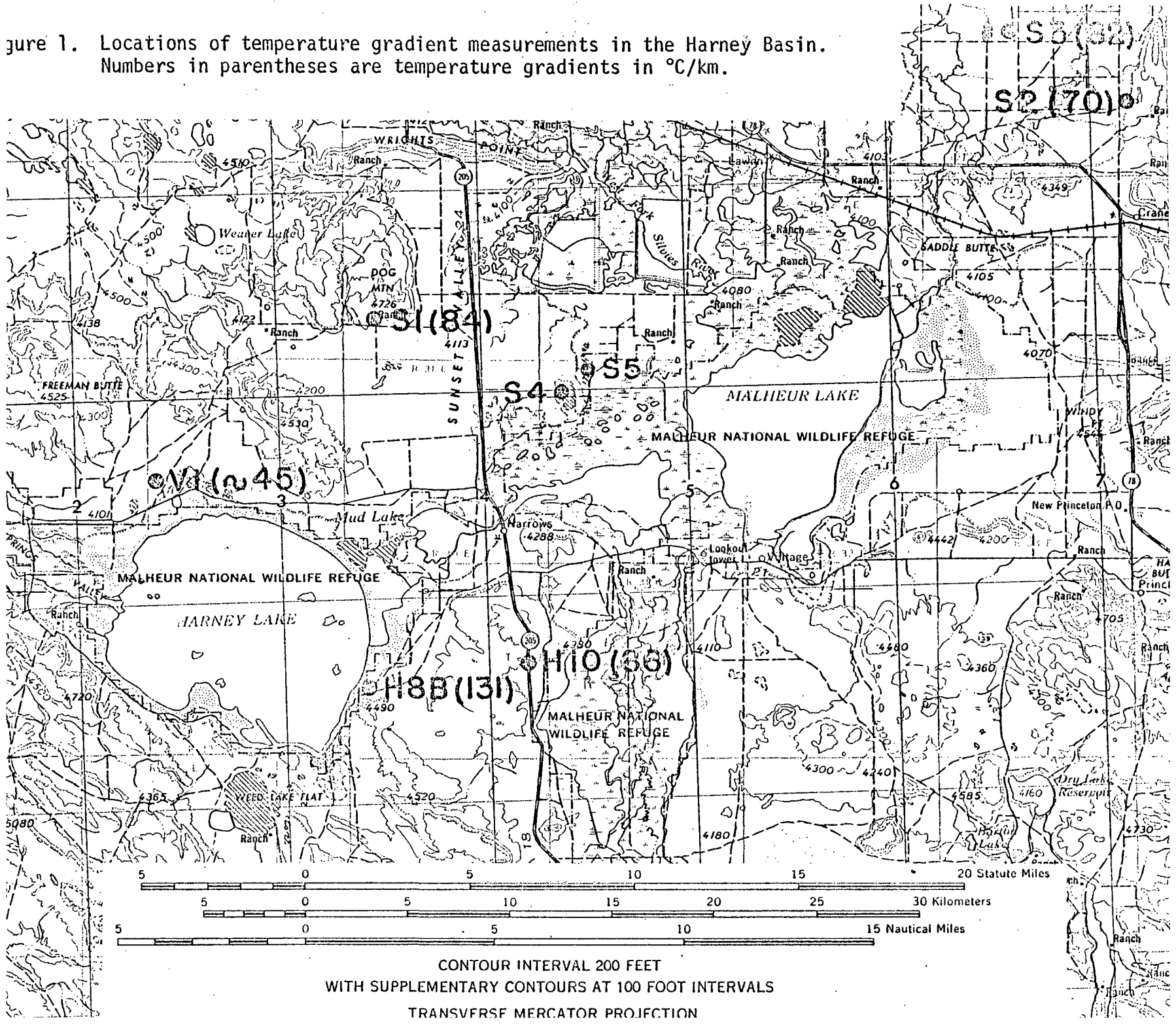
Temperature gradients in both areas vary by more than a factor of 2. Whether this reflects very variable conductivities in areas of uniform heat flow or local variations in heat flux cannot be resolved without further information.

The drilling of two or three test wells 100 to 150 m deep (including two or three 3-meter cores in each well) would probably suffice to determine the regional heat flux in Harney County. This latter quantity is probably necessary for any quantitative geothermal resource calculations

Reference

Bowen, R. G., Geothermal studies in Oregon: Ore Bin, v. 34, p. 68-71, 1972.

gure 1. Locations of temperature gradient measurements in the Harney Basin. Numbers in parentheses are temperature gradients in °C/km.



re 2. Temperature gradients in Southern Harney County (from Bowen, 1972). Numbers in parentheses are gradients in °C/km.

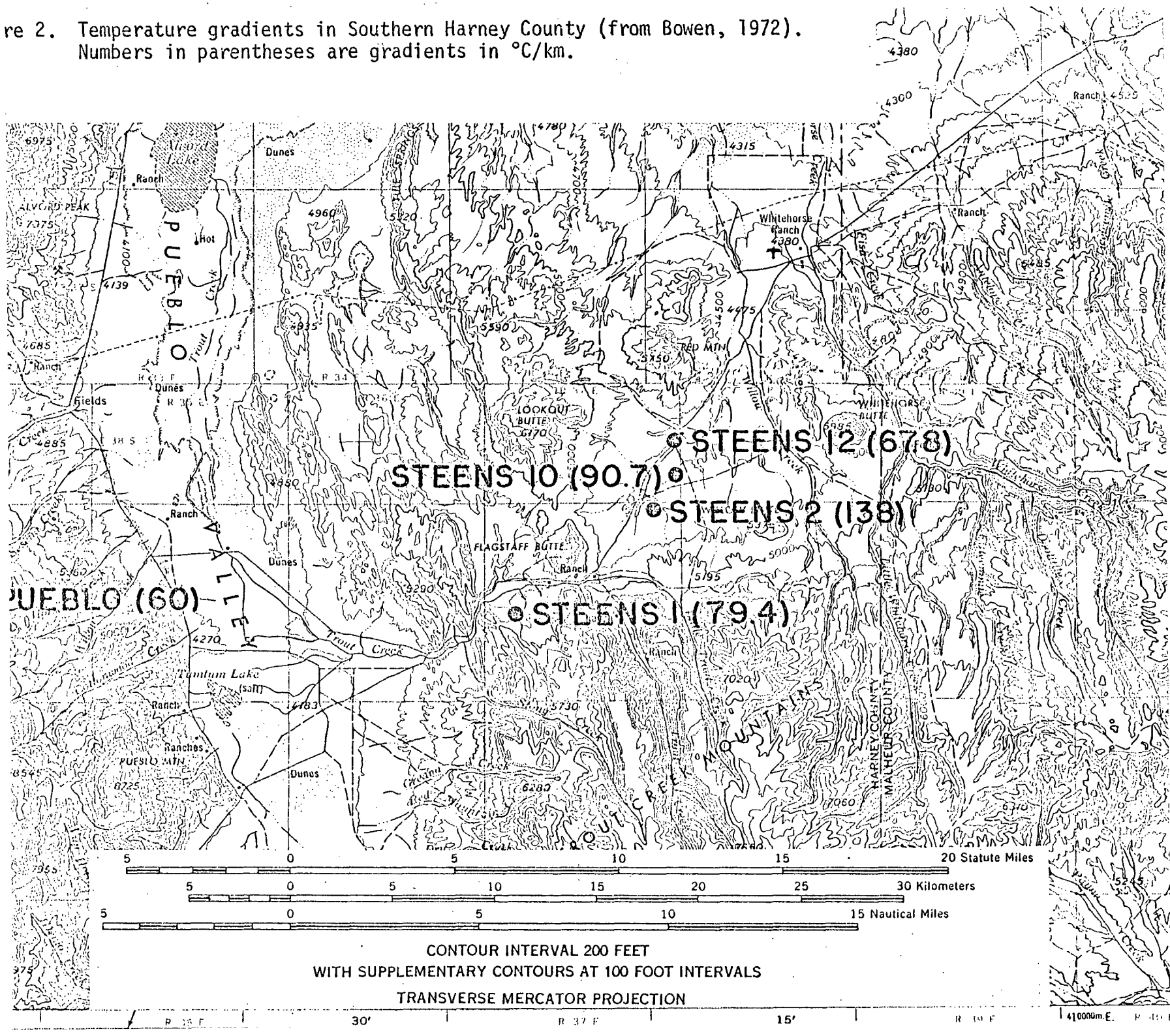


Figure 1. Locations of temperature gradient measurements in the Harney Basin. Numbers in parentheses are temperature gradients in °C/km.

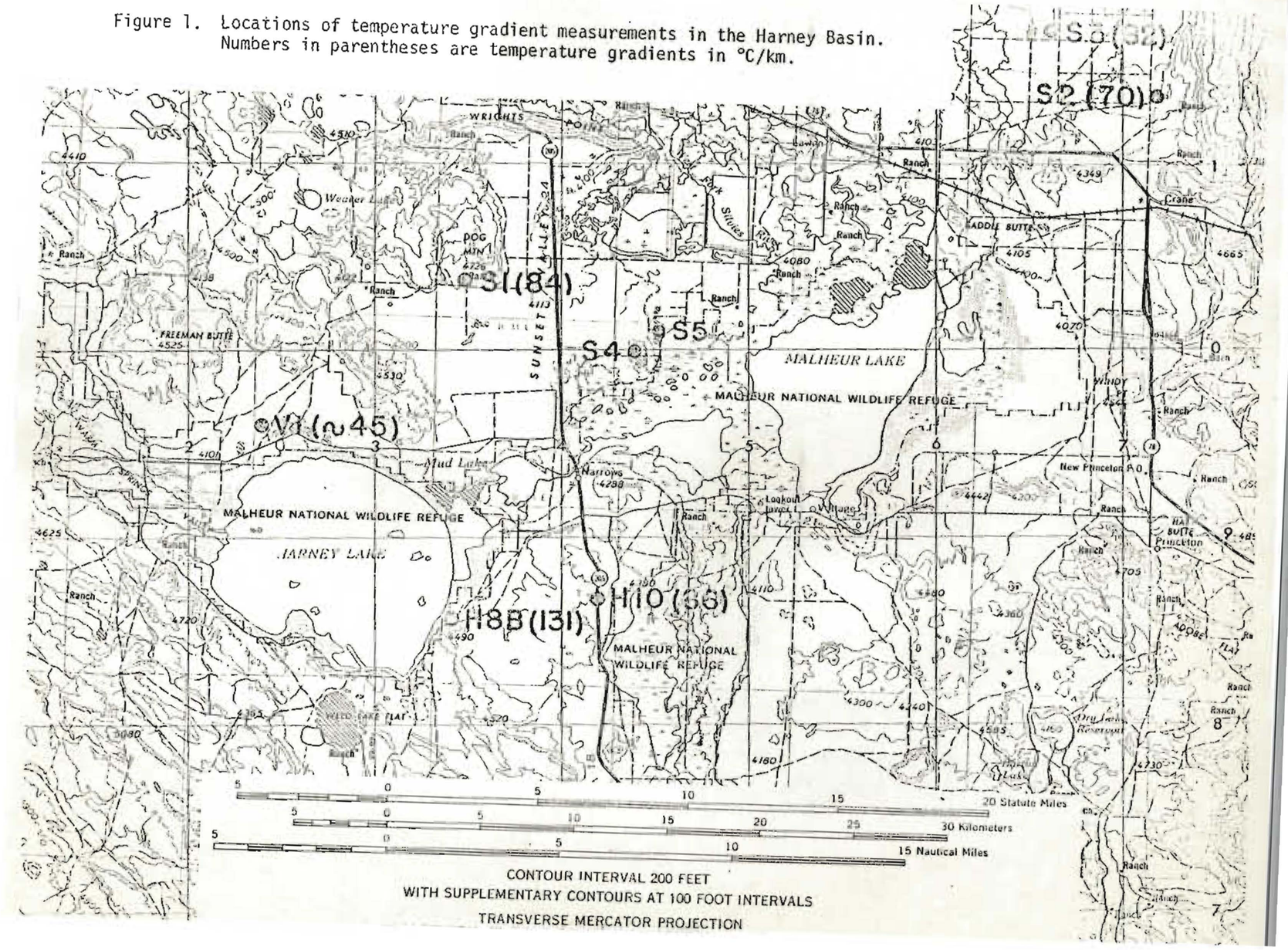
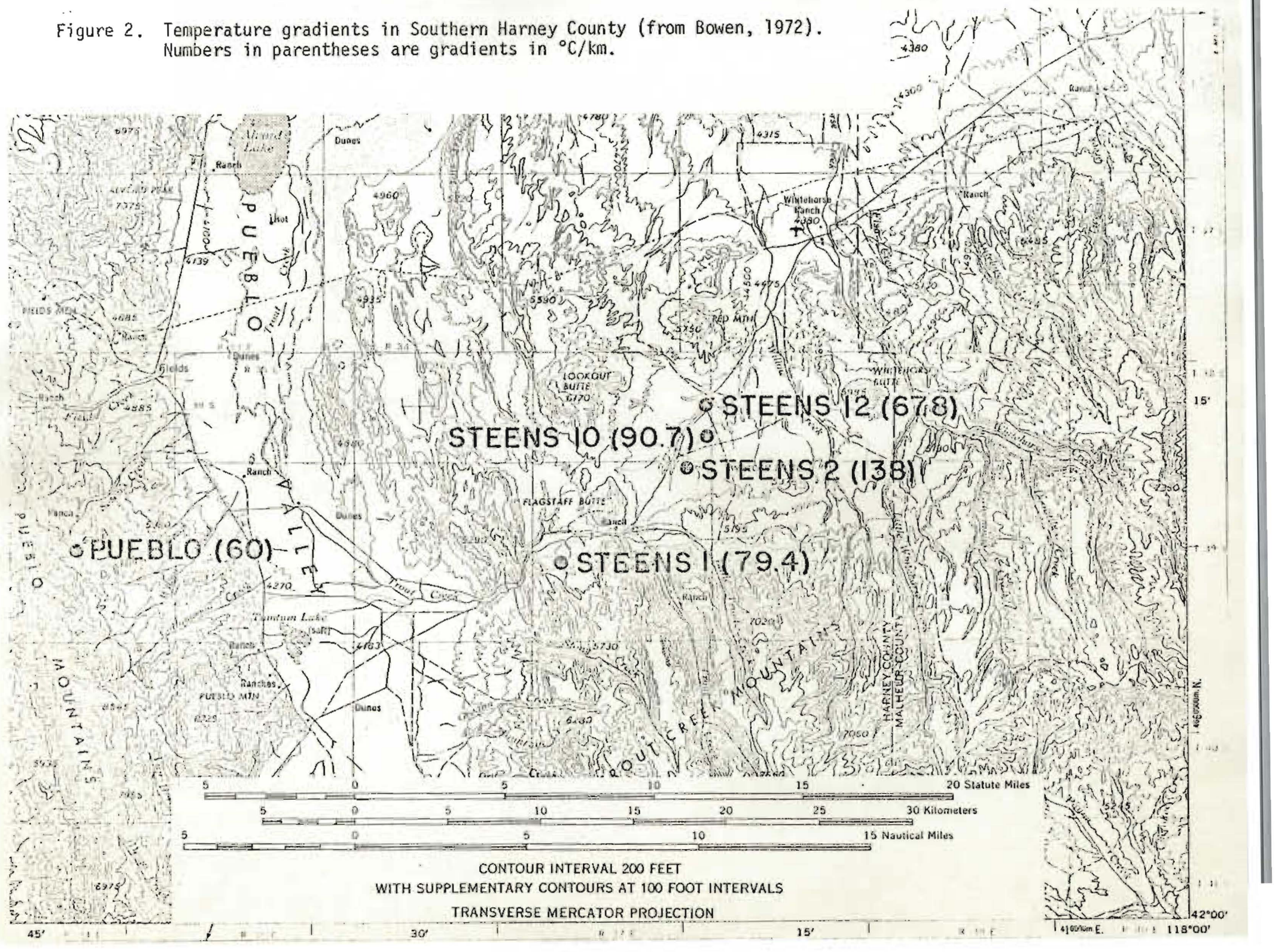
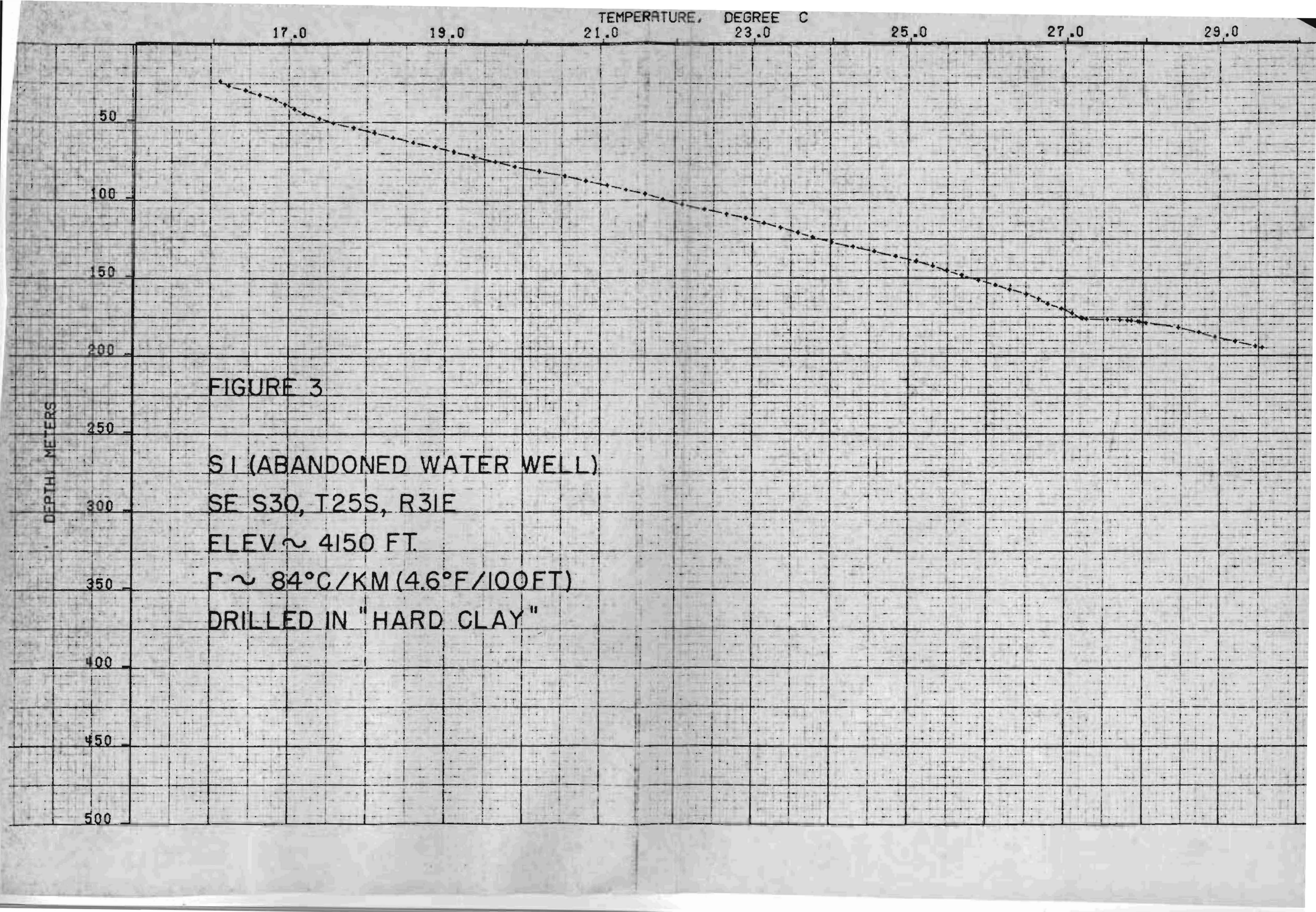


Figure 2. Temperature gradients in Southern Harney County (from Bowen, 1972). Numbers in parentheses are gradients in °C/km.




TEMPERATURE, DEGREE C
17.0
19.0
21.0
23.0
25.0
27.0
29.0
DEPTH METERS
50
100
150
200
250
300
350
400
450
500
FIGURE 3
SI (ABANDONED WATER WELL)
SE S30, T25S, R3IE
ELEV ~ 4150 FT.
Γ ~ 84°C/KM (4.6°F/100FT)
DRILLED IN "HARD CLAY"

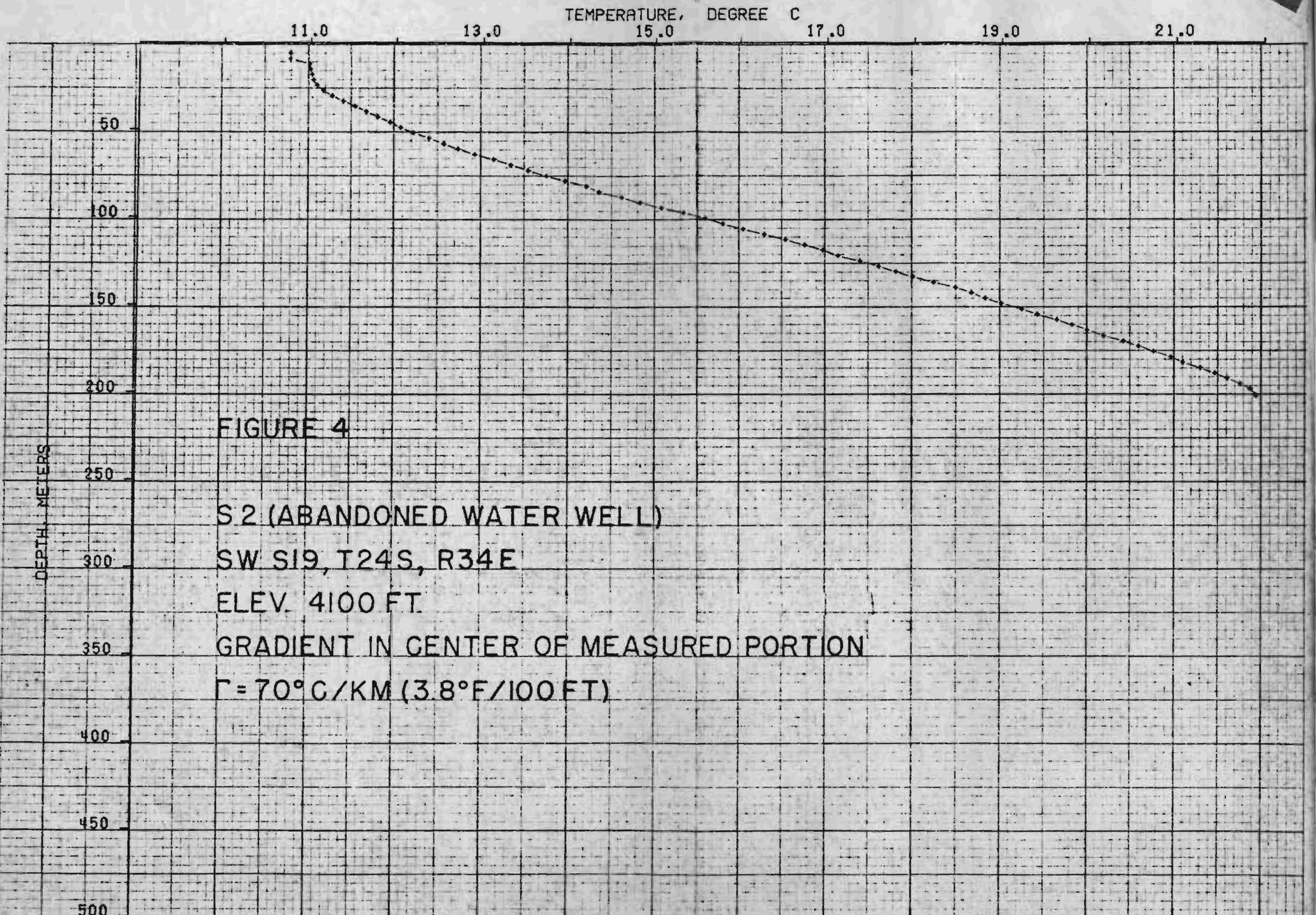


FIGURE 4

S 2 (ABANDONED WATER WELL)
SW S19, T24S, R34E
ELEV. 4100 FT.
GRADIENT IN CENTER OF MEASURED PORTION
Γ = 70° C/KM (3.8° F/100 FT)

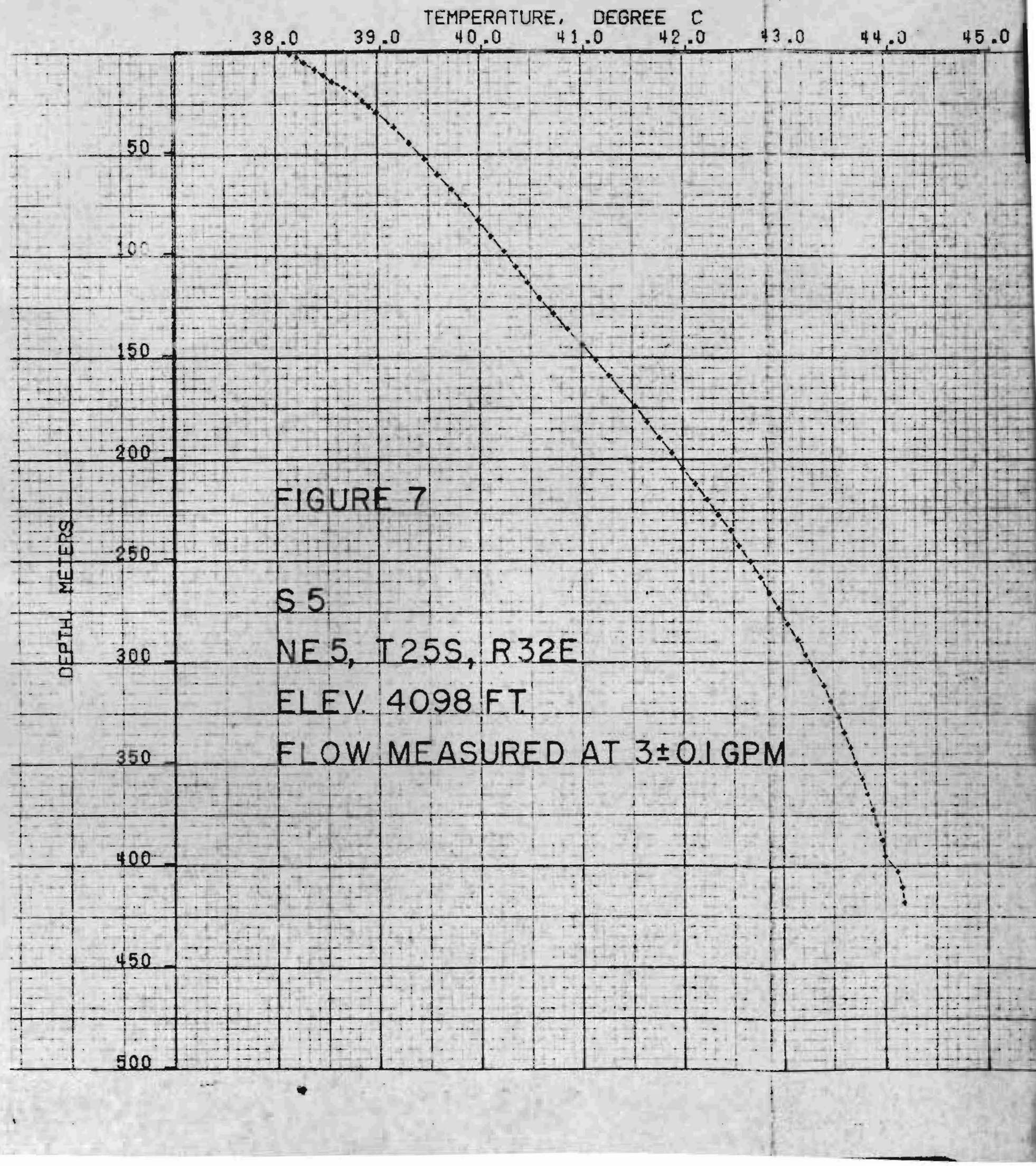
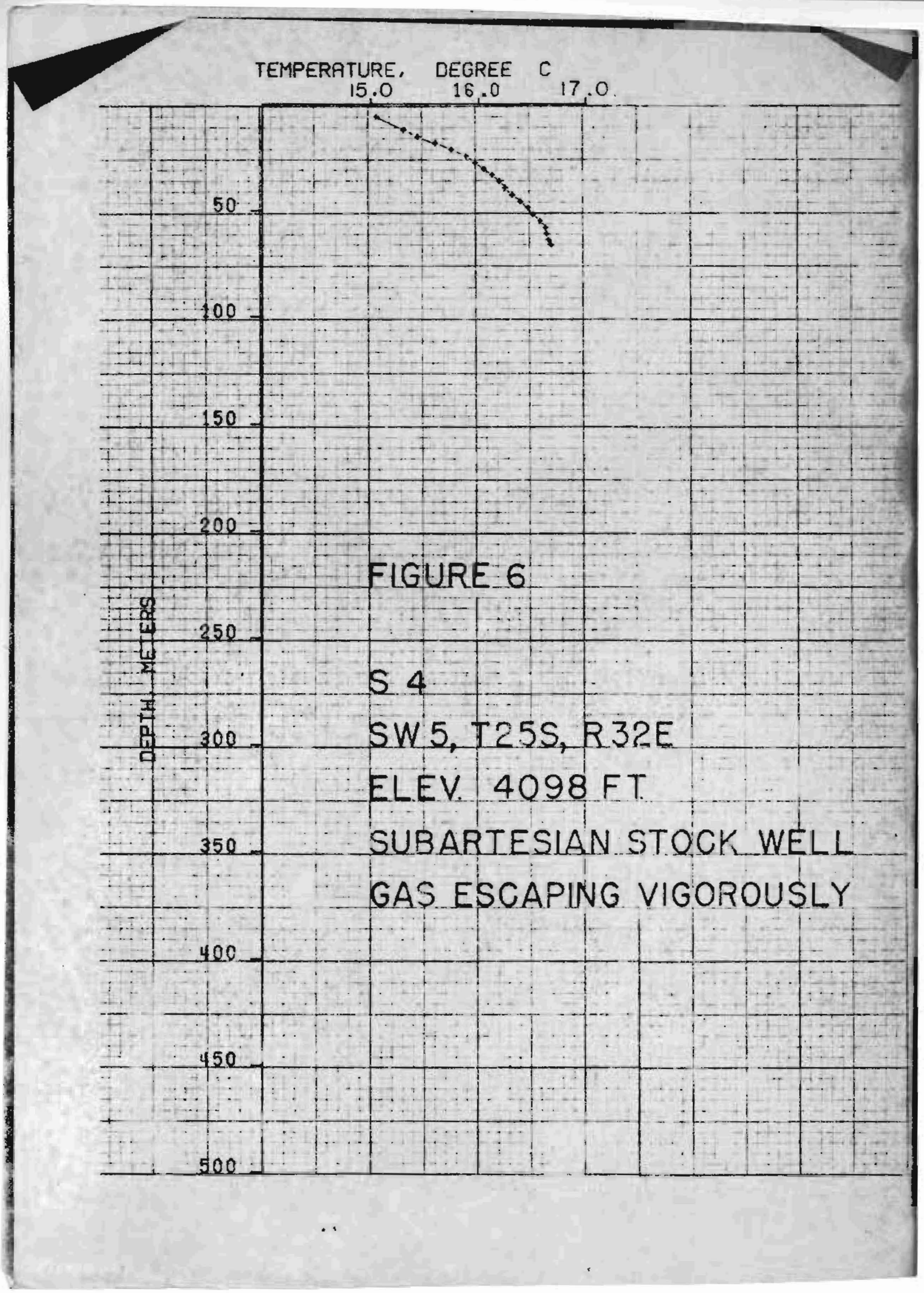

TEMPERATURE, DEGREE C
38.0
39.0
40.0
41.0
42.0
43.0
44.0
45.0
DEPTH, METERS
50
100
150
200
250
300
350
400
450
500
S 5
NE 5, T25S, R32E
ELEV. 4098 FT.
FLOW MEASURED AT 3±0.1 GPM

FIGURE 7


TEMPERATURE, DEGREE C
15.0
16.0
17.0
DEPTH METERS
50
100
150
200
250
300
350
400
450
500
FIGURE 6
S 4
SW 5, T25S, R32E
ELEV. 4098 FT.
SUBARTESIAN STOCK WELL
GAS ESCAPING VIGOROUSLY