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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Interpreted Resistivity and IP section Line W1 Wahmonie Area, Nevada Test Site, Nevada

by

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with an introduction

by

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This report is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards.

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Introduction

The U.S. Geological Survey, working under a memorandum of understanding EW-78-A-08-1543, with the Department of Energy, is engaged in a broad program to assess and identify potential repositories for high level nuclear waste on the Nevada Test Site (NTS), figure 1. The USGS program consists of integrated geologic, hydrologic and geophysical studies of regional to site specific nature. This report discusses work done at the proposed Wahmonie site at which active work has been suspended in part due to structural complexity, faulting and potential mineralization. This work provides the principal geophysical basis on which an assessment of potential mineralization was made.

The Wahmonie site was originally selected for study as a potential nuclear waste repository because of an inferred intrusive body at shallow depth in the area. An intrusive body was inferred due to the presence of a large aeromagnetic high, corresponding gravity high, a zone of alteration somewhat coincident with the geophysical anomalies and the presence of two small outcrops of granodiorite in the Wahmonie Hills, which from the magnetics, are probably cupolas on the parent intrusive. Studies were initiated to determine the nature and extent of the intrusive mass in order to assess its potential as a repository. This report covers the two dimensional modeling and interpretation of a dipole-dipole induced polarization (IP) line run across the center of the inferred mass. The modeling was done by the University of Utah Research Institute (UURI) under purchase order 83868 of the U.S. Geological Survey. A brief discussion of the geology is given in this introduction because the UURI report gives no discussion of the geological setting and because the results show significant potential for mineralization in the intrusive.

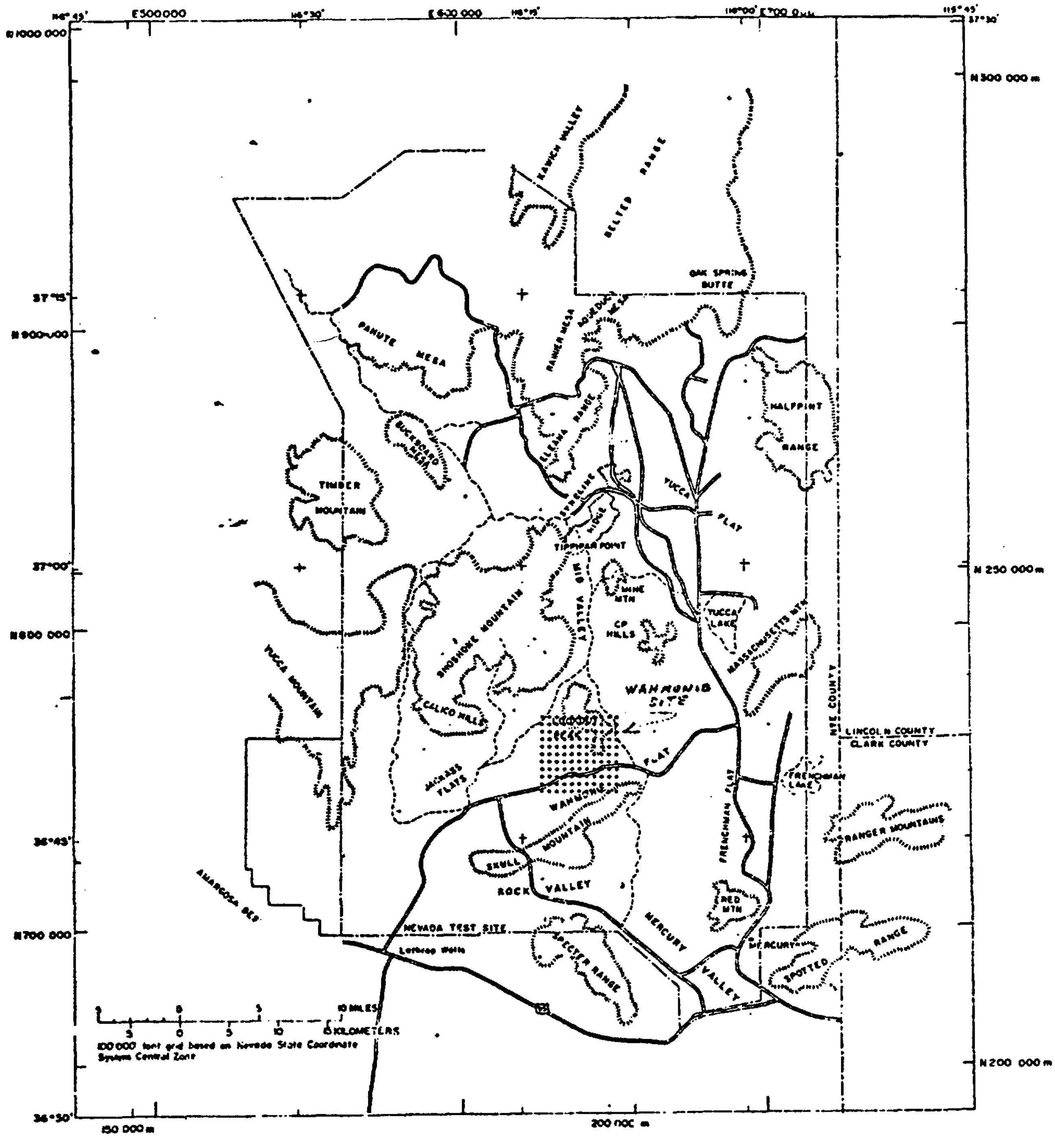

Figure 1. Index map showing the location of the Nevada Test Site and the Wahmonie area

A generalized picture of the geology is shown in Plate A adapted from Ekren and Sargent (1965). The extrusive rocks have been lumped as they appear to have no direct significance to the report. The Wahmonie Hills appear to be a horst block one mile wide trending northeast. Within the block on the southeast fault margin, occur two outcrops of Tertiary granodiorite which give rise to distinct local aeromagnetic anomalies. Within the horst block smaller outcrops of Tertiary andesite, rhyolite and intrusive breccia also occur. The remainder of the area shown is covered by Tertiary extrusive rocks or by Quaternary alluvium and colluvium, except for a very small outcrop in the horst of upper Paleozoic argillite (not shown on Plate A).

The gravity and magnetic data suggest that the centroid of the inferred intrusive is about 3/4 mile southeast of the abandoned Horn Silver mine (Plate A) (Howard Oliver, oral commun., 1980). Surrounding the horst block and extending several miles beyond on the south and east sides is a zone of hydrothermal alteration which correlates well with the gravity and magnetic data. Mining at the Horn Silver district occurred prior to 1905 and was reactivated in 1928 with a strike of high grade silver-gold ore (Cornwall 1972). The extensive alteration at Wahmonie was known as early as 1907 as Ball (1907) considered it a favorable guide to prospecting due to similarities with other gold and silver camps in the region.

The mining at Wahmonie was along faults in and adjacent to the southeast corner of the horst block. The ore was associated with quartz stringers and gypsum. Mining evidently was in the oxidized ore zone which is not surprising as the water table here is 2400 ft above sea level or about 1900 ft below surface. This is consistent with the derived IP model which shows polarization values, indicative of sulfides, increasing at from 1000 to 2000 ft depths along the line.

References

Ball, Sydney H., 1907, A geological reconnaissance in southwestern Nevada and eastern California: U.S. Geological Survey Bulletin 308.

Cornwall, H. R., 1972, Geology and mineral deposits of southern Nye Co. Nevada: Nevada Bureau of Mines and Geology Bulletin 77.

Ekren, E. B. and Sargent, K. A., 1965, Geologic map of the Skull Mountain quadrangle Nye County Nevada: U.S. Geological Survey Map GQ 387.

INTERPRETED RESISTIVITY/IP SECTION, LINE W1

WAHMONIE AREA, NEVADA TEST SITE

by

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CONTENTS

ILLUSTRATIONS

INTRODUCTION

A numerical model interpretation has been completed for Line W-1 of the Wahmonie area, Nevada Test Site. The work was completed as a separate work item under USGS Purchase Order 83868 which dealt primarily with the interpretation of resistivity/IP data from the Yucca Mountain Area (Smith and Ross, 1979). Geologic data were not available to the authors for the Wahmonie Area so the interpretation has been limited to a discussion of the modeling results.

INTERPRETATION

Line W-1 of the Wahmonie area trends S70°E on the eastern side of Jackass Flats at the Nevada Test Site. This line has been interpreted with a two-dimensional numerical algorithm described by Killpack and Hohman (1979). Two overlapping numerical models (Figs 1 and 2) closely match the observed resistivity data and reveal a two-layer, conductive-over-resistive geometry. The observed IP data show rapid vertical and lateral changes which suggest a complex PFE distribution; PFE generally increases with depth.

Plate I shows the resistivity/IP section interpreted from the two numerical models (Figs 1 and 2). Plate II summarizes key aspects of the interpretive section on a topographic map base. The section is divided at station 60W into two similar but distinct regions. East of station 60W, the surface layer is approximately 1,000 feet thick and has 60 to 80 ohm-m resistivities with small to moderate (0.4 - 2.2%) PFE responses. West of station 60W, the surface layer is as much as 2,000 feet thick and has significantly lower resistivities (10 - 25 ohm-m) and P.F.E responses (0.2 - 1.2%). Except for a local area below station 60W, the underlying layer is moderately resistive (200 ohm-m) and has a large (>6.5%) P.F.E response. Between stations 60W and 70W, the deeper resistive layer has lower intrinsic resistivities and P.F.E.

The increase in depth to the lower resistive layer and the decrease in the intrinsic resistivity and P.F.E near station 60W suggest the location of a fracture system or faulting with net displacement down to the west.

DISCUSSION

The resistivity/IP interpretation argues against storage of nuclear waste near station 60W but shows no other major structural or lithologic changes in this area.

Measurements of induced polarization and resistivity on laboratory samples and on outcropping mineralized rock have led to empirical relationships for estimating sulfide content from these parameters. One such relationship is

$$\omega = \left\{ \frac{45 \times PFE}{\rho} \right\}^{\frac{1}{2}}$$

where W = weight percent sulfides

ρ = intrinsic resistivity in ohm-m

PFE = intrinsic frequency effect in per cent.

The <u>interpreted</u> resistivity and P.F.E underlying much of line W-1 at depths of 2,000 feet are 200 ohm-m and 8.0 P.F.E respectively, which suggests a minimum of 1 to 2 weight percent sulfides. This estimate of sulfides, in association with the numerous prospects and mines 2,000 feet north of line W-1 indicates a high mineral potential for a relatively large area.

The mineral potential of the Wahmonie area could be significant at some future time so this area should be given a very low priority as a nuclear waste repository site.

REFERENCES

Killpack, T. J., and Hohmann, G. W., 1979, Interactive dipole-dipole resistivity and IP modeling of arbitrary two-dimensional structures (IP2D Users guide and documentation): ESL report no. 15, DOE/DGE contract No. EG-78-C-07-1701.

Smith, C., and Ross, H. P., 1979, Interpretation of resistivity and induced polarization profiles with severe topographic effects, Yucca Mountain area, Nevada Test Site: ESL report no. 21, USGS purchase order 83868, (in press).

Figure 1 Wahmonie Line W-1 West/2 Iter. 7 1"= 2000'

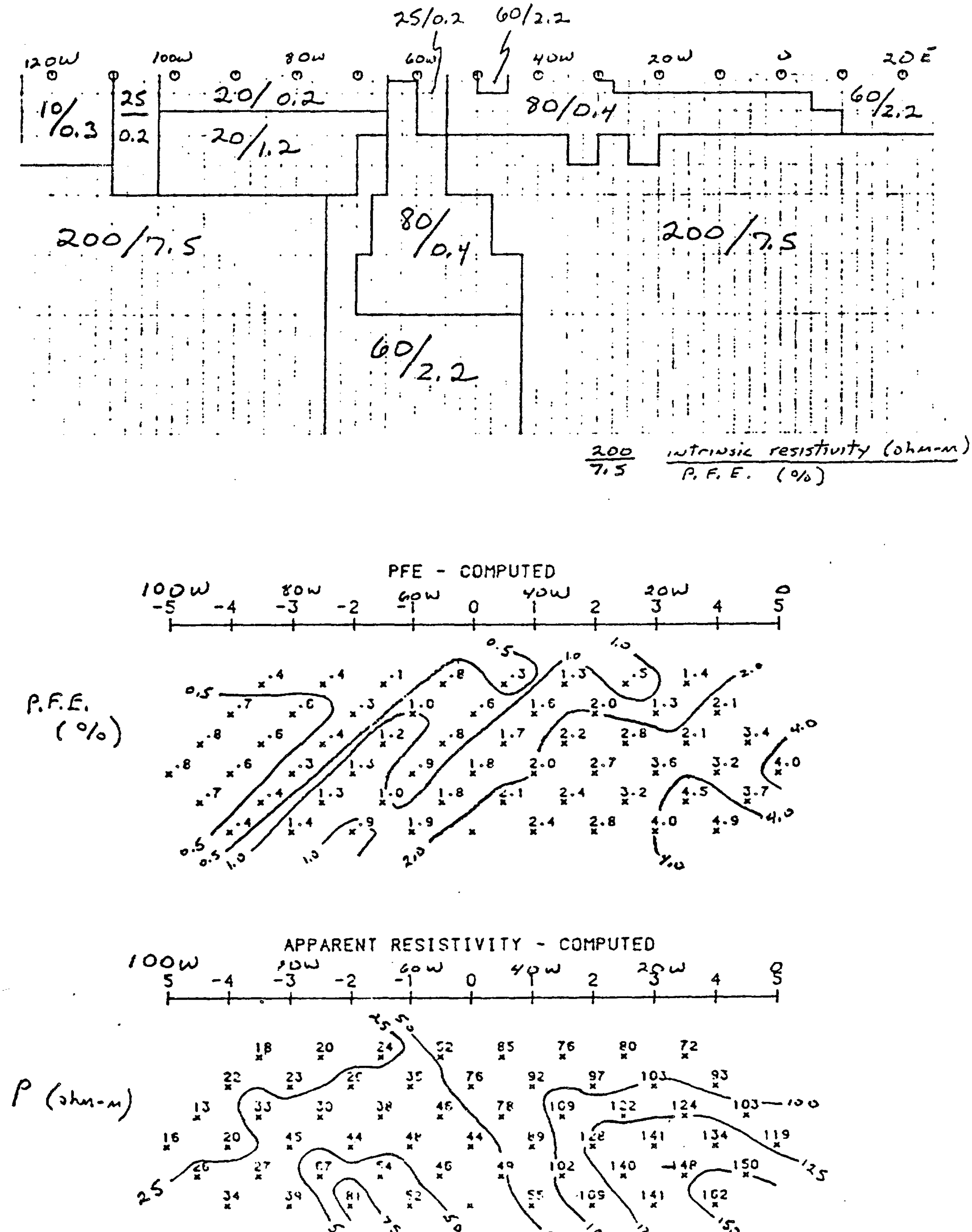
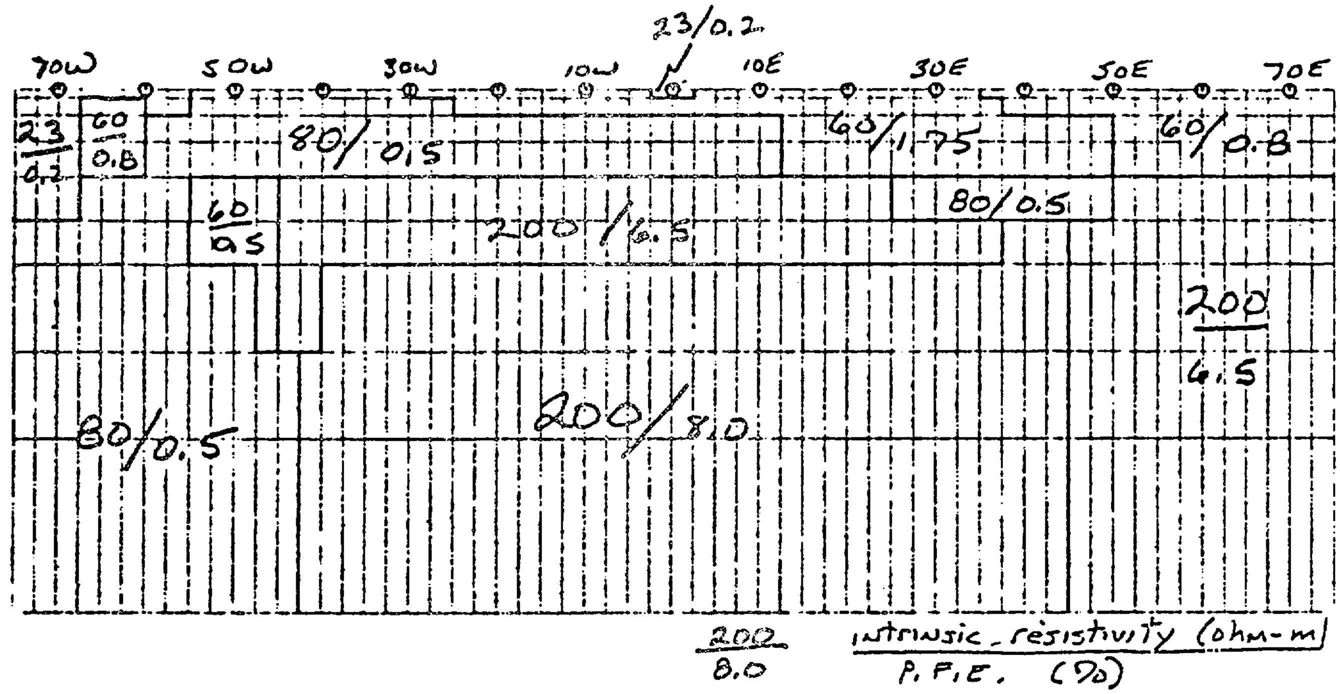
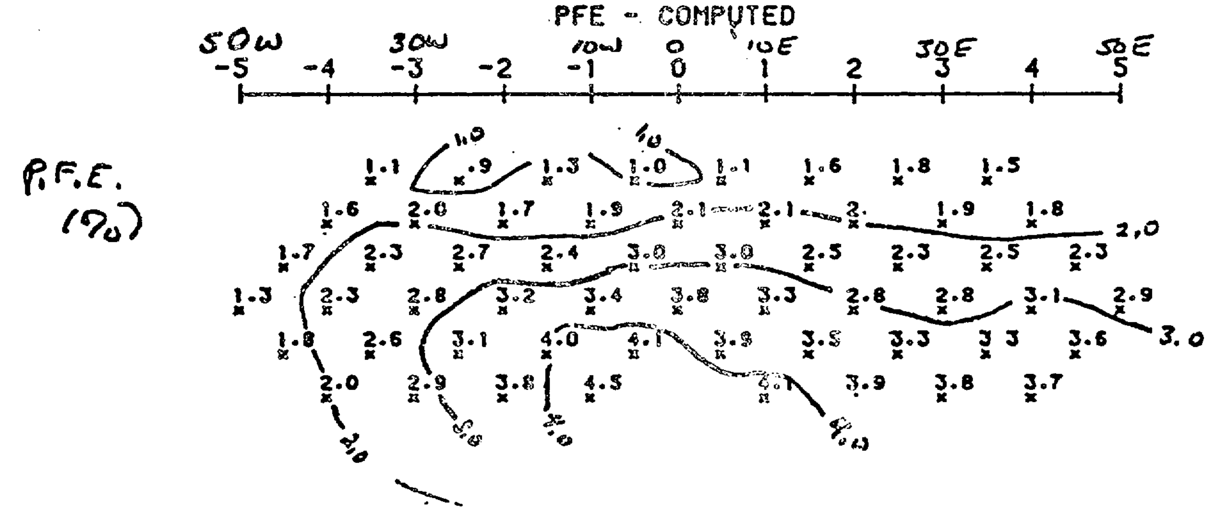


Figure 2

Wahmonie Line W-1 East/2 Iter. 3 1" = 2000'



PFE - COMPUTED



APPARENT RESISTIVITY - COMPUTED