REGIONAL PARKS

EAST BAY REGIONAL PARK DISTRICT

LETTER OF TRANSMITTAL

To: Juilet Shin
Dept. of Environmental Health
80 Sway Way, Room 200
Oakland, CA 94621

Date: May 6, 1993

Subject: Redwood Regional Park - Oakland, CA 94619
Removal of a U.G. Leaking 5,000 Gals Unleaded Gas Tank and Contaminated Soil.

We are sending you herewith:

____Prints, ____Tracings, ____Working drawings,

____Specifications, ____Correspondence, ____Photographs,

X Geological and Geophysical Investigation for Ground-Water Supply - Redwood Regional Park, Report Dated September 1980.

For the following action:

__X__For your information, __X__For your records, ____For your review,

____For your action, ____Please return, ____Please retain one copy and return the others with corrections and comments,

Comments: Per my phone conversation on 5/5/93 with Eva Chu, Eva suggested that I send you a copy of this report. If you have any questions, please give me a call at 635-0135, Ext. 2311. Thank you.

Drawing Number	Date of original or revision	Copies	Description

Parkland Design Department

BY: Warren Gee

2950 Peralta Oaks Court • P.O. Box 5381 • Oakland CA 94605 0381 • 510.635.0135 • FAX 510.569.4319

GEOLOGICAL AND GEOPHYSICAL INVESTIGATION
FOR GROUND-WATER SUPPLY
REDWOOD CANYON, REDWOOD REGIONAL PARK
ALAMEDA COUNTY, CALIFORNIA

For

Mr. Tim Coates

September 1980

GEOCONSULTANTS, INC.
Consultants in Engineering and Geology
1450 Koll Circle, Suite 114
San Jose, California 95112
Telephone: (408) 286-4251

Project No. G413-01
September 3, 1980

East Bay Regional Park District
11500 Skyline Blvd.
Oakland, CA 94619

Attention: Mr. Tim Coates

RE: GEOLOGICAL AND GEOPHYSICAL INVESTIGATION
FOR GROUND-WATER SUPPLY
REDWOOD CANYON, REDWOOD REGIONAL PARK
ALAMEDA COUNTY, CALIFORNIA

Dear Mr. Coates:

In accordance with your Purchase Order No. 12209 dated August 15, 1980, we have completed our evaluation of the potential for developing a ground-water supply in the subject area. The results of this investigation, which involved the research of available data and on-site evaluation by geological and geophysical methods, are contained in the attached report.

We anticipate meeting with you to discuss our investigation, after you have had the opportunity to review this report. We are tentatively planning to meet sometime during the week of September 15; please let us know as soon as possible which day you will be available. Until that time, if you have any questions concerning the data, conclusions or recommendations presented, please do not hesitate to contact us. It has been a pleasure performing this service for you, and we look forward to meeting with you soon.

Very truly yours,

GEOCONSULTANTS, INC.

Debra J. Moser
Project Geologist

Jeremy C. Wire
Engineering Geologist (EG-71)

DJM/JCW:kj

TABLE OF CONTENTS

GEOLOGICAL AND GEOPHYSICAL INVESTIGATION
FOR GROUND-WATER SUPPLY
REDWOOD CANYON, REDWOOD REGIONAL PARK
ALAMEDA COUNTY, CALIFORNIA

INTRODUCTION

This report presents the results of a geological and geophysical survey performed in order to evaluate the ground-water potential at the subject site. We understand that a yield of 100,000 gallons per day is desired, to provide sufficient water for irrigation and general park use.

The scope of work included in this investigation consisted of a review of pertinent geologic literature,* a geologic reconnaissance of the Redwood Canyon area, and a geophysical survey described below under FIELD INVESTIGATION.

REGIONAL GEOLOGIC SETTING

Redwood Regional Park is located in the San Leandro Hills east of the city of Oakland. The geology in this area is characterized by a series of northwest-southeast trending folds and faults. Numerous small dip-slip faults cross-cut the folds. Bedrock units consist primarily of shales, sandstones, and conglomerates of Cretaceous to Tertiary age.

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*See Selected References

Redwood Canyon trends along a fault which cuts the northeast limb of the Grass Valley Syncline, the axis of which lies along the western ridge of the park (See Figure 1). The bedrock exposed in the canyon is mapped as Redwood Canyon formation, consisting of sandstone and shale, and Pinehurst Shale. These units dip moderately steeply to the southwest. Three small cross faults have been mapped on the northeast side of Redwood Canyon.

Ground water occurring in this type of geologic environment is generally found in the fractured bedrock, such as along the cross faults, or migrating along bedding planes, buried channels, and/or contacts between the sandstone and shale.

FIELD INVESTIGATION

A surface geologic reconnaissance and six magnetometer traverses were performed on August 19, 1980; and six vertical electrical soundings were performed on August 21, 1980. The locations of these surveys are shown on the Site Plan, Figure 2.

Ground Magnetometer Survey

The ground magnetometer survey indicates areas underlain by channels or the most intense fracturing in the subsurface. A Geometrics G186 portable magnetometer unit was used, with readings taken at 20-foot intervals along the traverse. Magnetic highs can generally be attributed to

rocks of relatively high magnetism. Conversely, the magnetic low points are generally associated with materials of lower magnetism and discontinuous zones such as fractures. However, buried pipes, high voltage wires, metal debris, and similar objects can adversely affect the readings and cause abnormal magnetic peaks. The profiles showing vertical magnetic intensity along the six magnetometer traverses are shown on Figures 3 through 9. As indicated on the attached profiles, several magnetically anomalous areas were detected. These were further explored by vertical electrical soundings (see below).

Vertical Electrical Soundings

Six vertical electrical soundings were performed to evaluate subsurface conditions at the locations shown on the Site Plan, using a Geowestern X-1 direct current earth resistivity apparatus. The sounding locations were selected to evaluate not only the magnetically anomalous areas, but also to explore several different geologic/hydrologic environments.

Essentially, a vertical electrical sounding (VES) may be considered as an electrical "drill hole" with the depth of exploration being roughly equivalent to the electrode separation. The thickness of the subsurface strata with different resistance to the passage of current between the electrodes is measured. Generally, dry and

dry material, have a relatively high resistivity, and clay and shale have a relatively low resistivity. The results of the six soundings are presented on Figures 10 through 15 as graphs showing the electrode separation (or depth of sounding) plotted against apparent resistivity. True resistivity, which is used in the evaluation of the nature of the subsurface materials, is obtained by matching as closely as possible the field-derived curve to a family of resistivity curves developed for an ideally homogeneous, layered earth.

Sounding VES-1 was performed along the main road, near the entrance to the fire road; and VES-2 was performed near the entrance to the existing parking area. These locations are close to the projected intersections of small cross faults with the main fault trending through Redwood Canyon. Interpretation of these soundings suggests that both locations are underlain (in addition to shallow stream deposits) by hard sandstone to the total depth explored of 400 feet. No major zones of free ground water are indicated.

Sounding VES-3 was performed at the northern end of the study area, just northeast of the mapped trace of the main fault. Interpretation of this sounding indicates stream deposits or sandstone to a depth of 30 feet underlain by generally dry shale or interbedded shale and sandstone materials to the total depth explored of 400 feet.

Sounding VES-4 was performed near the northern end of the playground across from the Maple Picnic Area, in an area mapped by Radbruch (1969) as the intersection of the main fault with a minor fault separating shale and sandstone units. The sounding encountered roughly 20 feet of dry shale or sandstone, underlain by an apparently water-saturated section to a depth of approximately 60 feet. Below 60 feet, another unsaturated section of shale extends to a depth of approximately 120 feet. A second zone of possible saturation extends from 120 to 160 feet, which in turn appears to be underlain by sandstone or interbedded shale and sandstone materials to the total depth explored of 300 feet.

Sounding VES-5 was performed on the fire road, approximately 1150 feet south of the north end of the study area. The sounding was located southwest of the main fault. Interpretation of the sounding curve indicates dry shale materials to the total depth explored of 400 feet.

Sounding VES-6 was performed on the fire road, essentially across the creek from VES-2. This sounding evaluated the subsurface environment at the foot of a small swale west of the main fault. Interpretation of the sounding suggests that hard, dry sandstone extends to a depth of approximately 80 feet, underlain by a zone of possible saturation to a depth of 115 feet. Below this depth, intermittent saturation in sandstone appears to extend to the total depth explored of 400 feet.

CONCLUSIONS

Based on the results of our investigation of the Redwood Canyon area, it is our opinion that the potential for developing a ground-water supply does exist. The most promising areas for drilling test wells are at the locations of geoelectrical soundings VES-4 and VES-6 (Figure 2). At the site of VES-4, shale bedrock which apparently is hard and fractured is "wedged" between sandstone strata and two fault planes. The resulting configuration allows ground water to be stored in the open fractures. Fracturing in sandstone bedrock at the location of VES-6 also allows ground-water storage. A small, unmapped cross fault may explain the fracturing here.

It should be noted that, because the magnetic anomalies were subtle and the resistivity survey did not indicate extensive water-bearing zones, the desired yield of 100,000 gallons per day (about 70 gallons per minute) may not be attainable on a sustained basis from just one or two wells in the study area. However, the synclinal axis or "trough" trending along the crest of the ridge west of Redwood Canyon may form a favorable environment for ground-water storage. Thus, further evaluation of this area may be warranted if well yields in the canyon are not sufficient for the proposed usage.

RECOMMENDATIONS

A step-by-step recommended program for test drilling is presented below.

1. A preliminary meeting should be planned prior to any test drilling to discuss the conclusions and recommendations presented herein and to assure that a total understanding is achieved concerning the future course of action in evaluating the ground-water potential. This meeting is tentatively scheduled for the second week following issuance of this report.
2. A test well should be drilled in the vicinity of vertical electrical sounding VES-4, as shown on the Site Plan and staked and flagged in the field. A test hole at this location, depending on conditions encountered, should be drilled to a depth of 300 feet to adequately evaluate the ground-water potential. Further penetration beyond 300 feet is recommended as long as water-bearing strata are encountered, since the thicker the water-bearing section, the greater the yield of the well.
3. If the yield of the test well is not satisfactory, a second test well should be drilled at the location of VES-6, which also is staked and flagged in the field and shown on the Site Plan. This hole should penetrate to a minimum depth of 300 feet, with

similar provisions for further penetration as discussed above.

4. Depending upon the results of the test drilling you may wish to have electrical logs made in one or both holes to help determine potential yield and water quality.
5. If the test wells exhibit satisfactory conditions, they should be completed with casing and test pumped to determine their capacity.

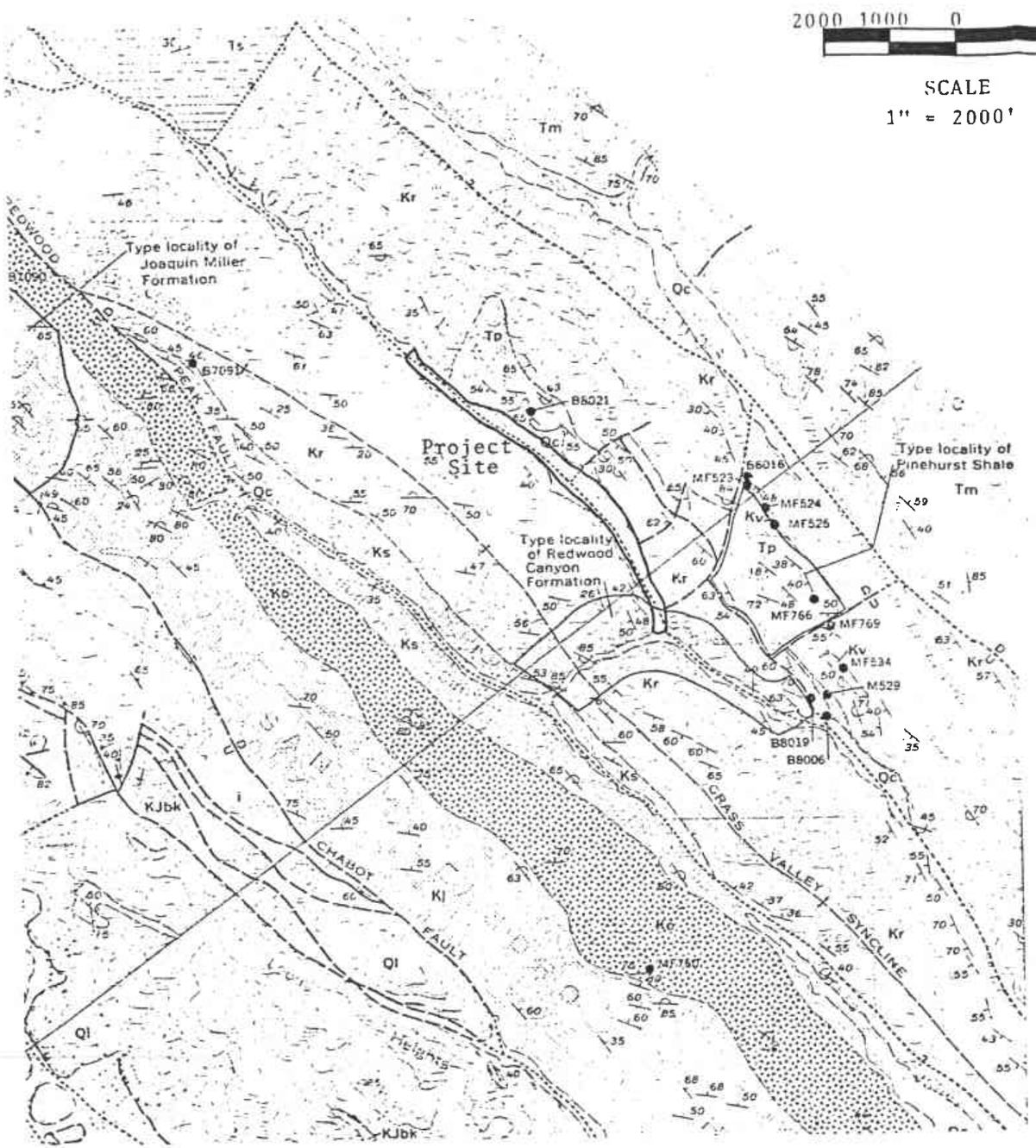
LIMITATIONS

No guarantee is made that water will be found in any specific quantity or mineral quality at proposed test well locations or within any specific depth intervals stated in this report. However, this report, consisting of professional opinions and recommendations, has been made in accordance with generally accepted principles and practices in the field of engineering geology and hydrology. This warranty is in lieu of all other warranties either expressed or implied.

* * * * * * *

SELECTED REFERENCES

1. Case, J. E.; 1968; Upper Cretaceous and Lower Tertiary Rocks, Berkeley and San Leandro Hills, California: U. S. Geological Survey Bulletin 1251-J; 29 p.
2. East Bay Regional Park District; Adopted August 2, 1977; Redwood Regional Park, Land Use-Development Plan Environmental Impact Report; Resolution No. 1977-8-226.
3. East Bay Regional Park District; Adopted September 16, 1975; Redwood Regional Park, Resource Analysis; Resolution No. 1975-9-179; Revised October 1977.
4. Radbruch, D. H.; 1969; Areal and Engineering Geology of the Oakland East quadrangle, California: U. S. Geological Survey Map GQ-769.



LEGEND

Qc — Alluvium and artificial cover

Tm — Monterey Group

Ts — Sedimentary rocks

Tp — Pinehurst Shale

Kr — Redwood Canyon Formation

Ks — Shephard Creek Formation

Ko — Oakland Conglomerate

Ki — Joaquin Miller Formation

Contact
Dashed where approximately located or gradational; dotted where concealed; queried where uncertain

Fault, showing dip
Dashed where approximately located; dotted where concealed; queried where uncertain or inferred. D, apparent downthrown side. Arrows show direction of apparent or inferred displacement.

Syncline, approximately located
Showing trace of axial plane

Strike and dip of beds
Normal — Overturned

NOTE: Geology after Case, 1968.

REGIONAL GEOLOGIC MAP

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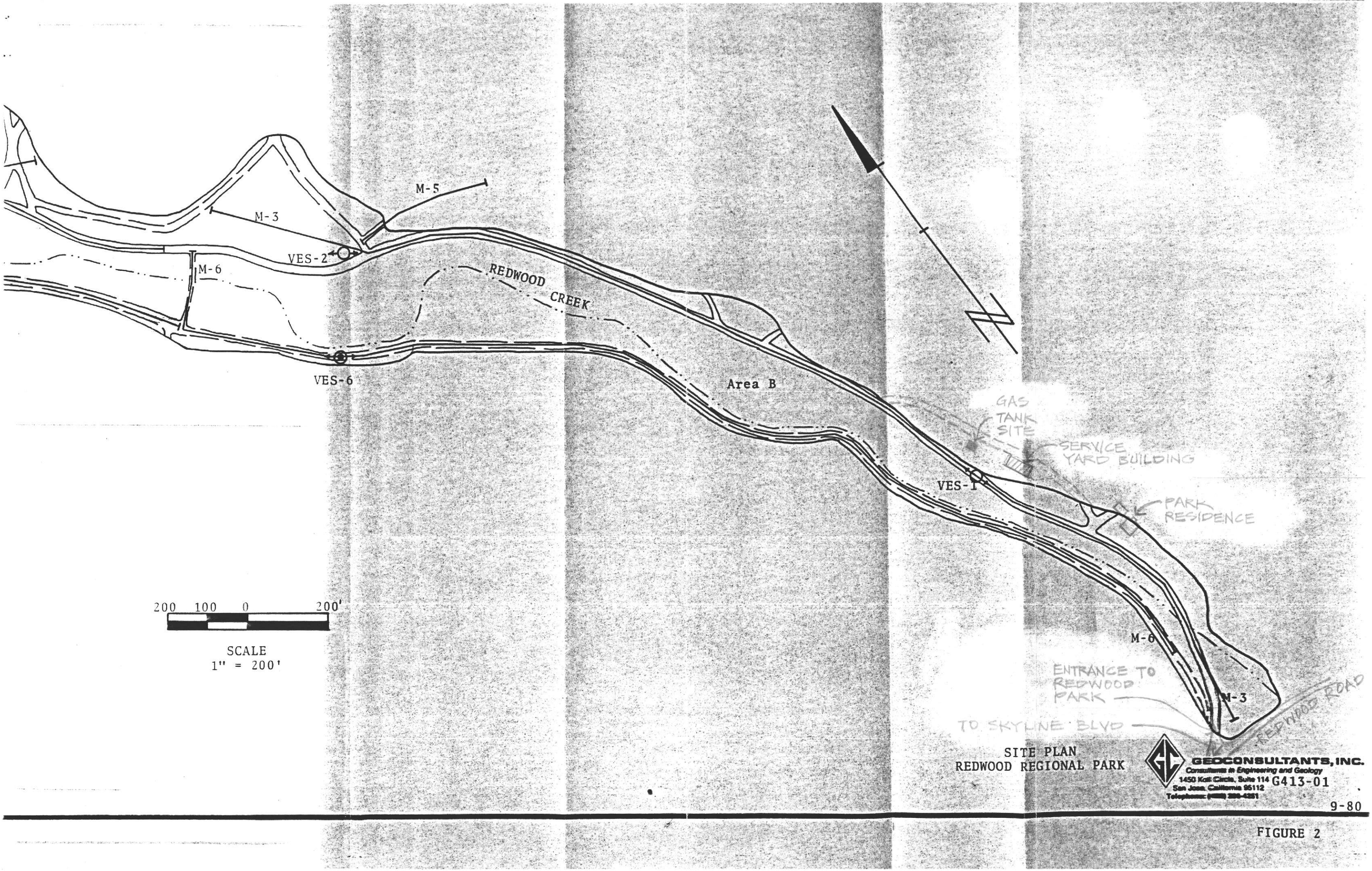
9-80

FIGURE 1



SITE PLAN
REDWOOD REGIONAL PARK

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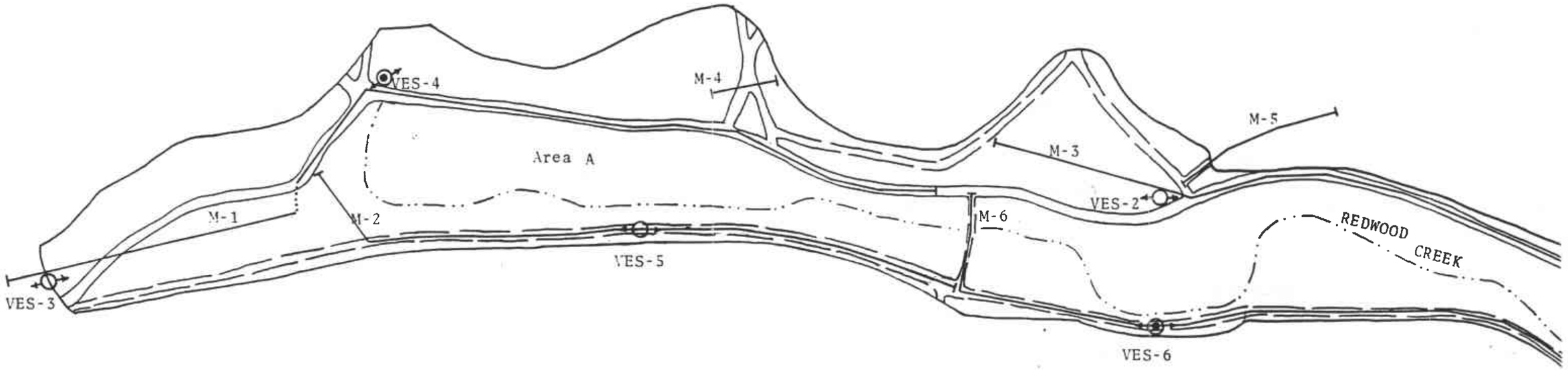
FIGURE 2



LEGEND

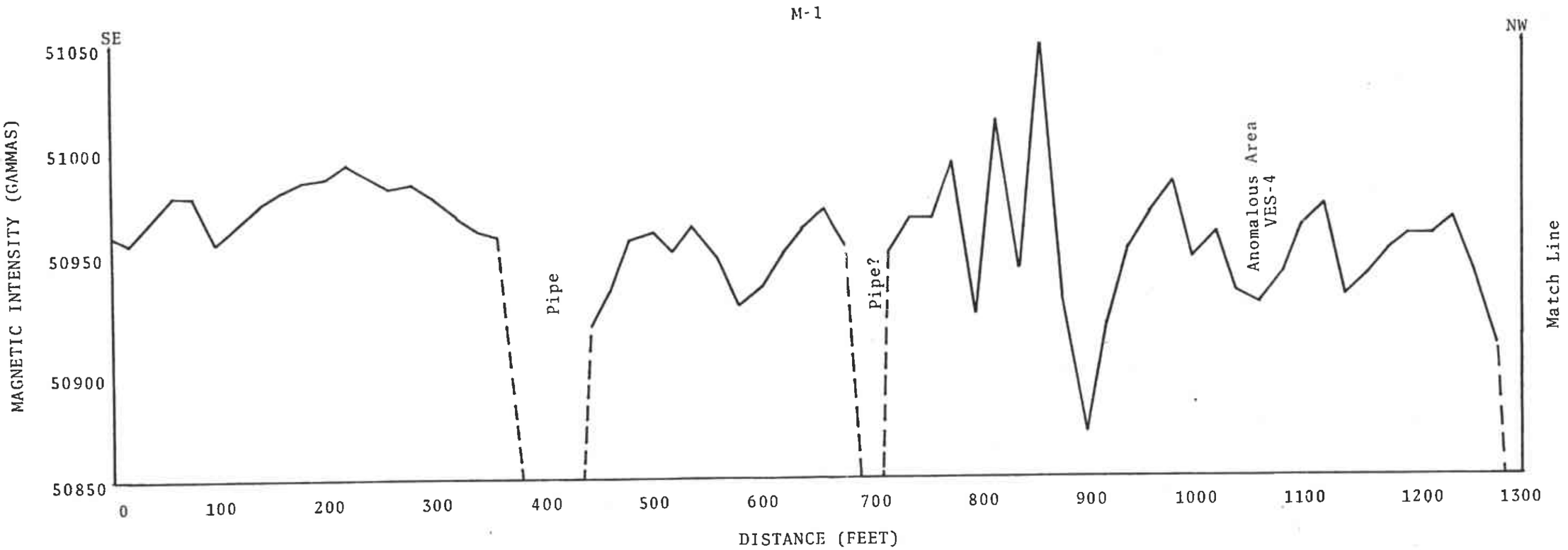
M-6 Magnetometer Traverse

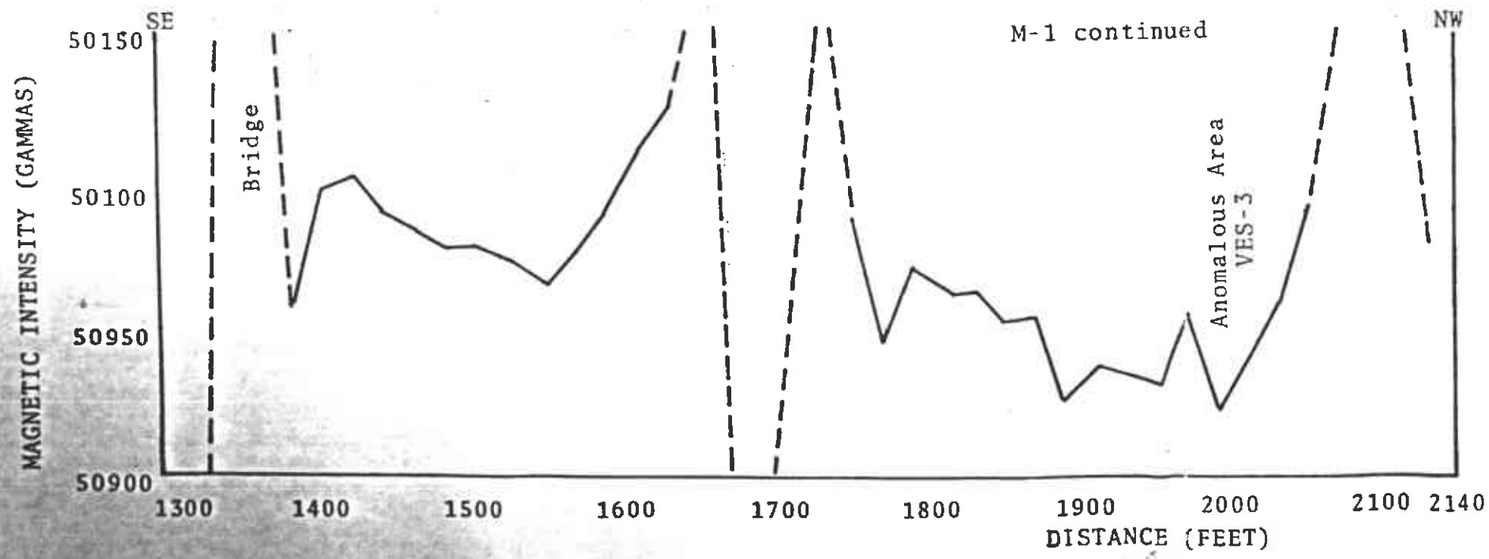
VES-6 Vertical Electrical Sounding

• Proposed Test Well Location

200 100 0 200'

SCALE
1" = 200'





MAGNETIC INTENSITY

M-1

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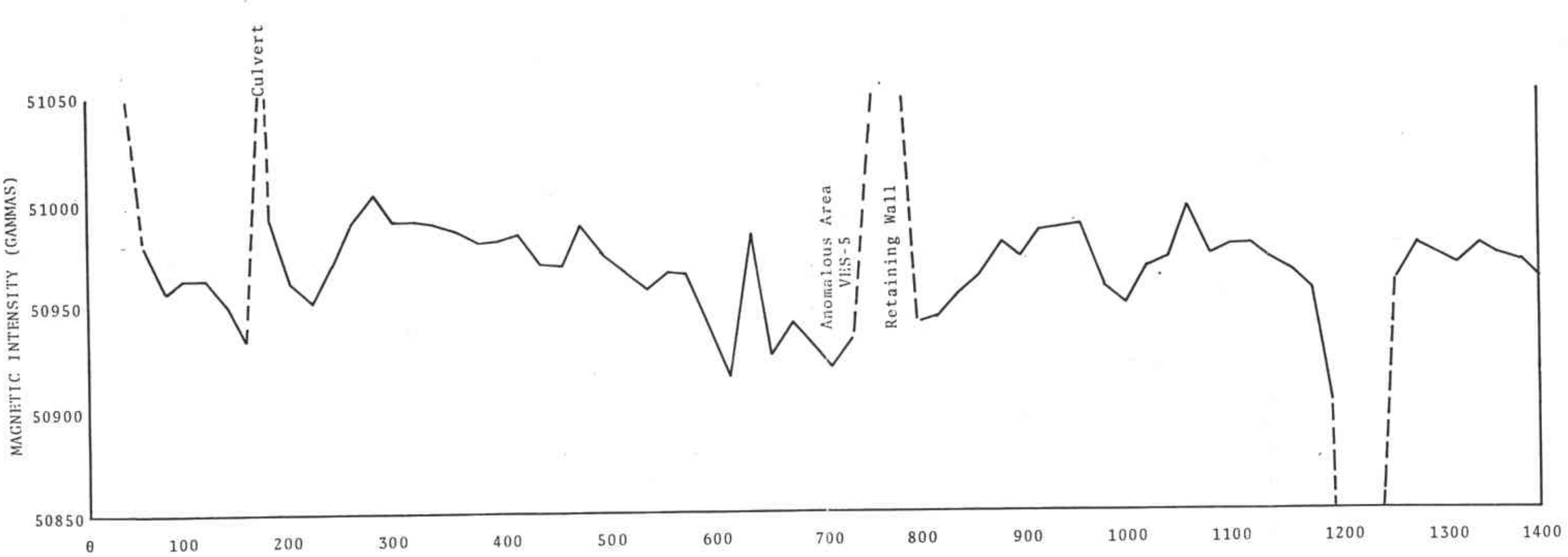
FIGURE 3

M-2



MAGNETIC INTENSITY

M-2

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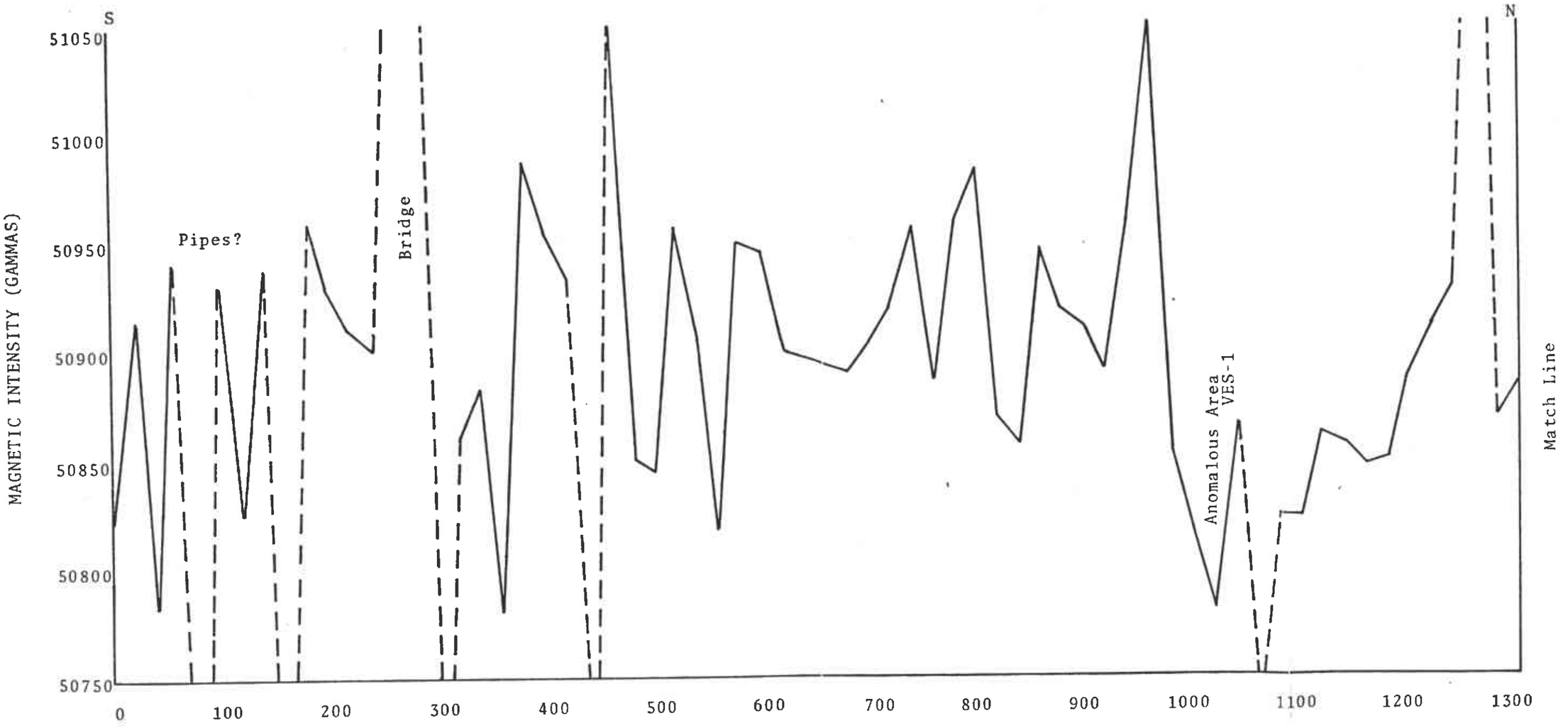
FIGURE 4



MAGNETIC INTENSITY
M-3

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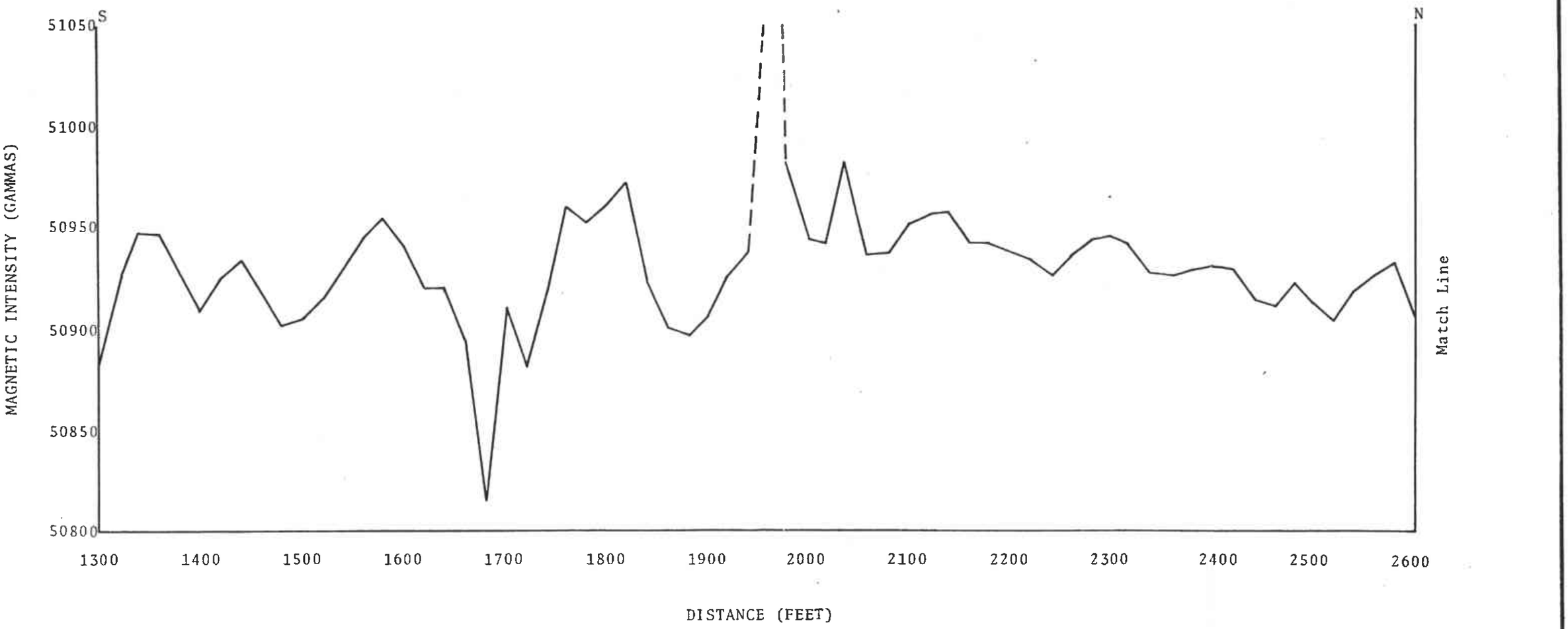
FIGURE 5



MAGNETIC INTENSITY
M-3 continued

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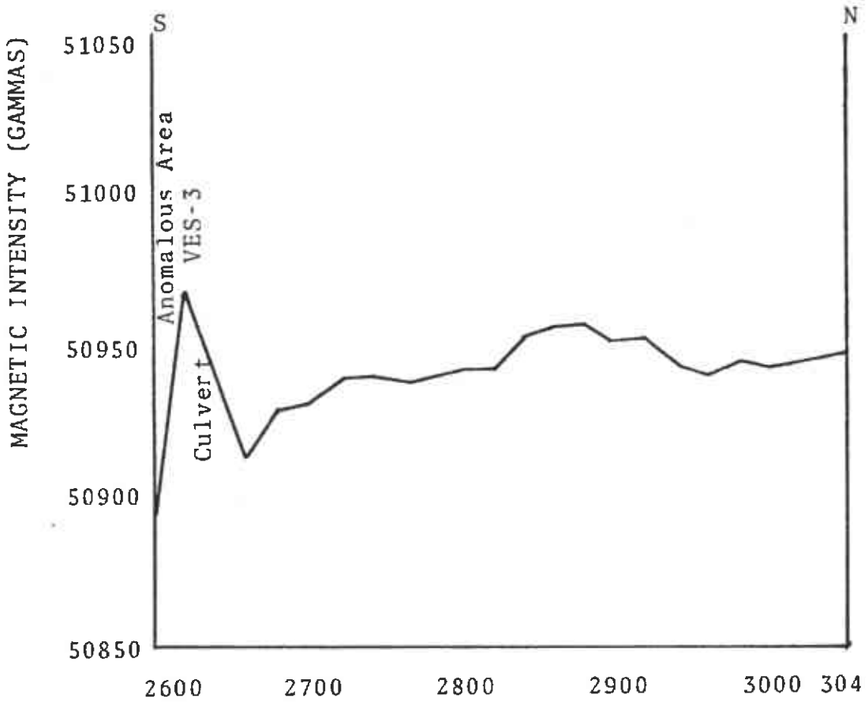
FIGURE 6

M-3 continued



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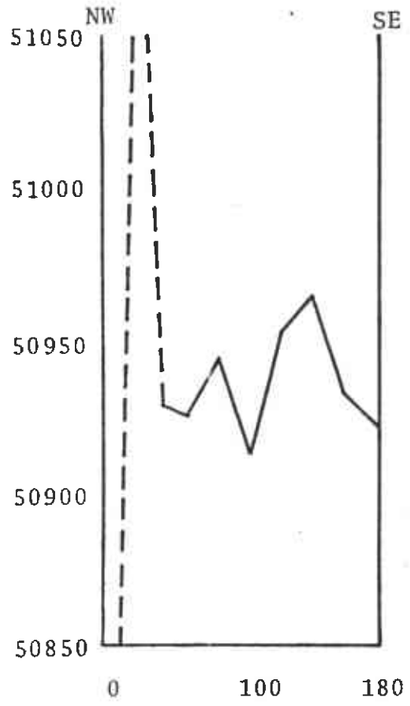
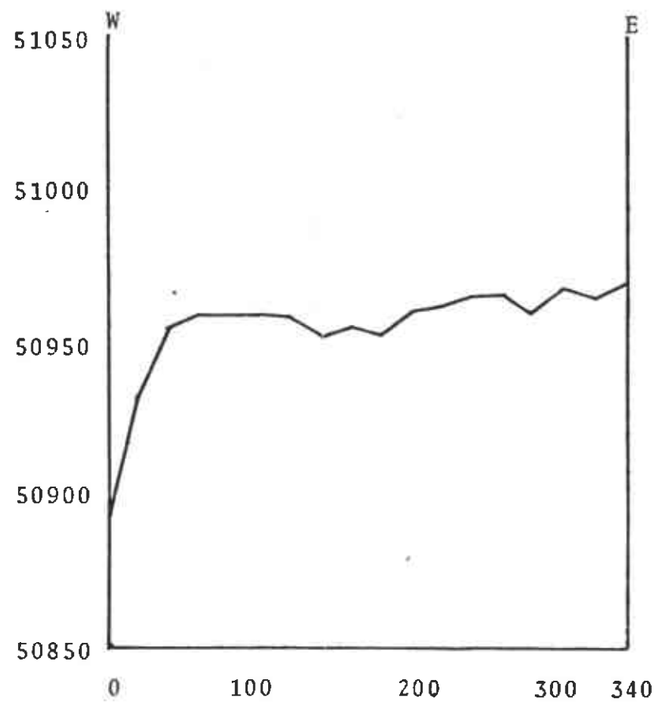


M-5



MAGNETIC INTENSITY
M-3 continued,
M-4 & M-5

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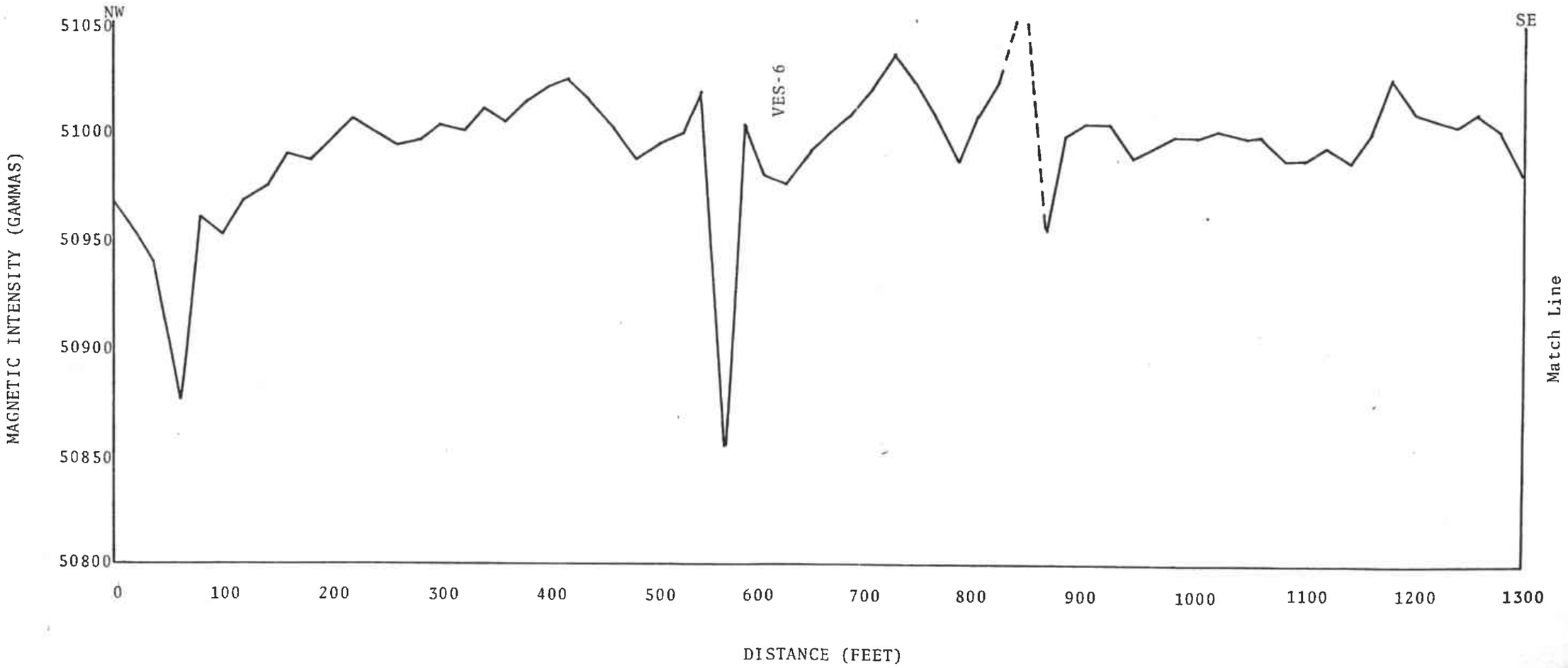
FIGURE 7



MAGNETIC INTENSITY
M-6
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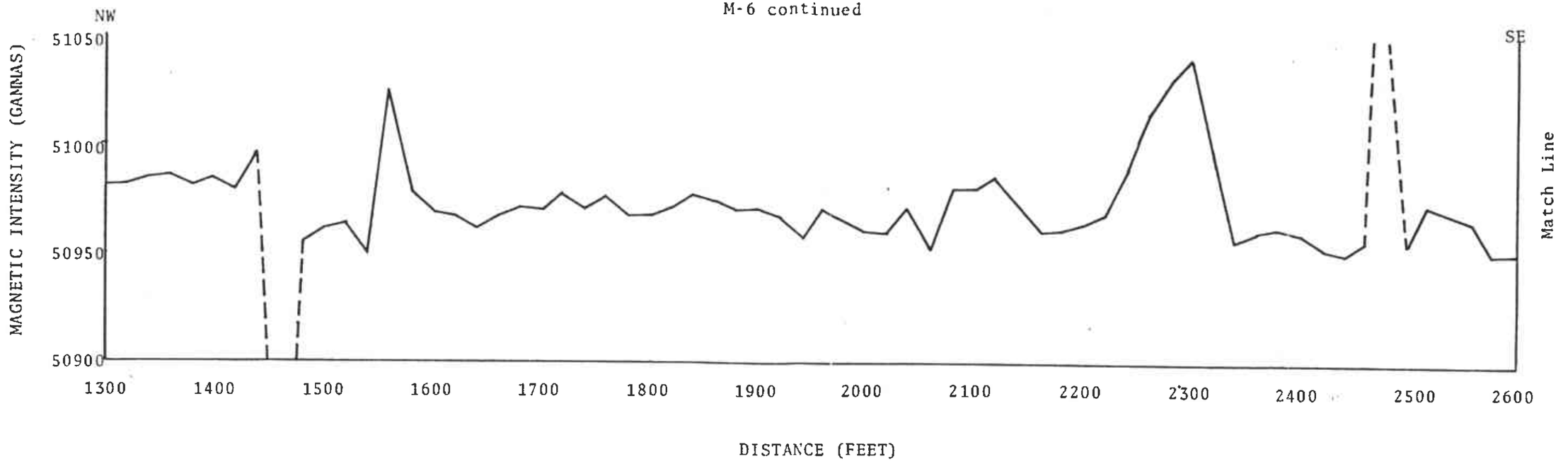
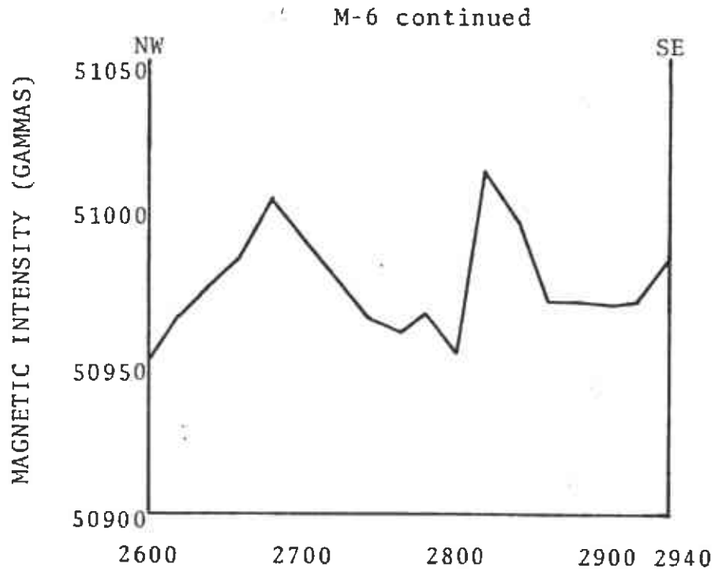
9-80

FIGURE 8





MAGNETIC INTENSITY
M-6 continued

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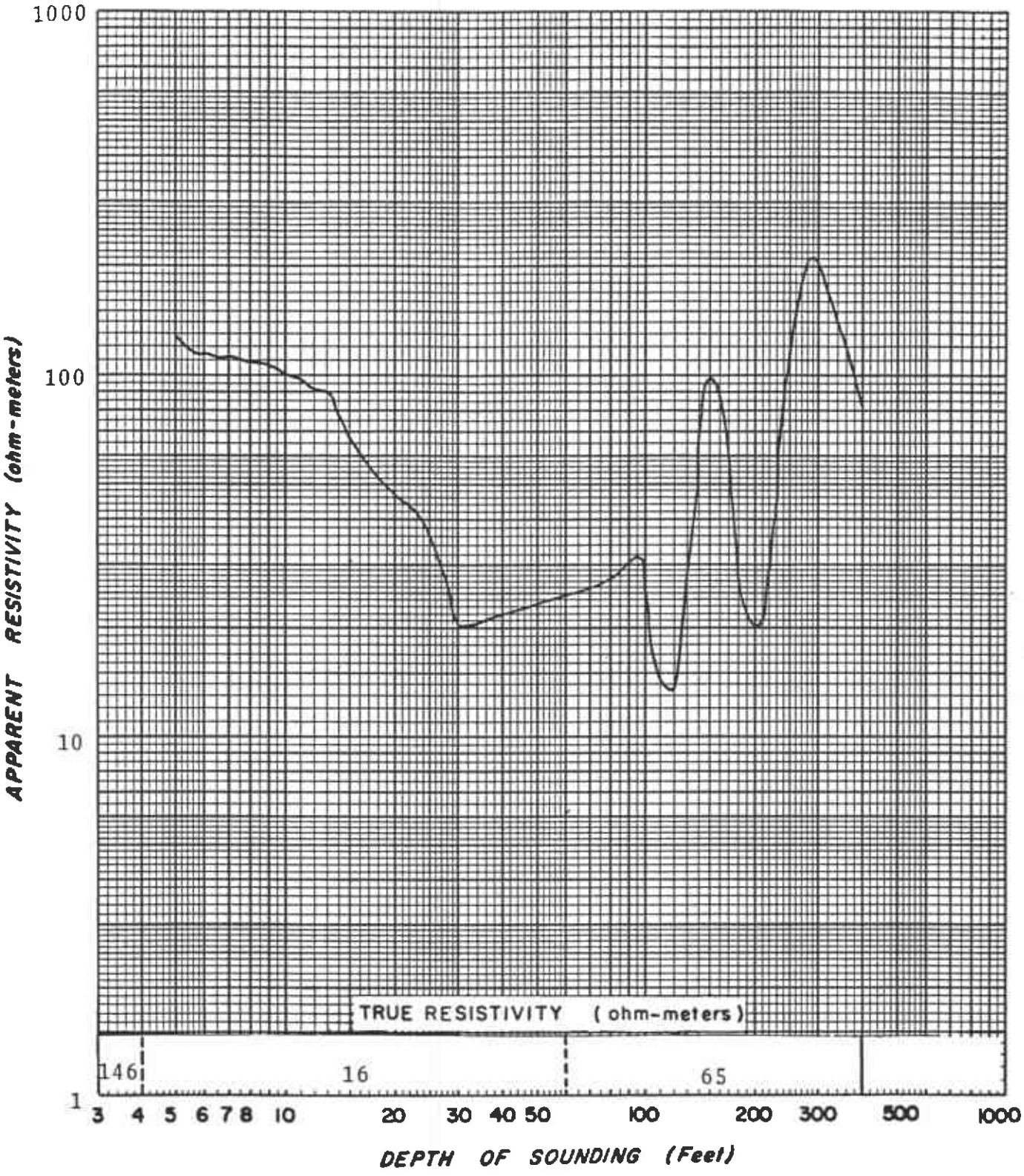
FIGURE 9



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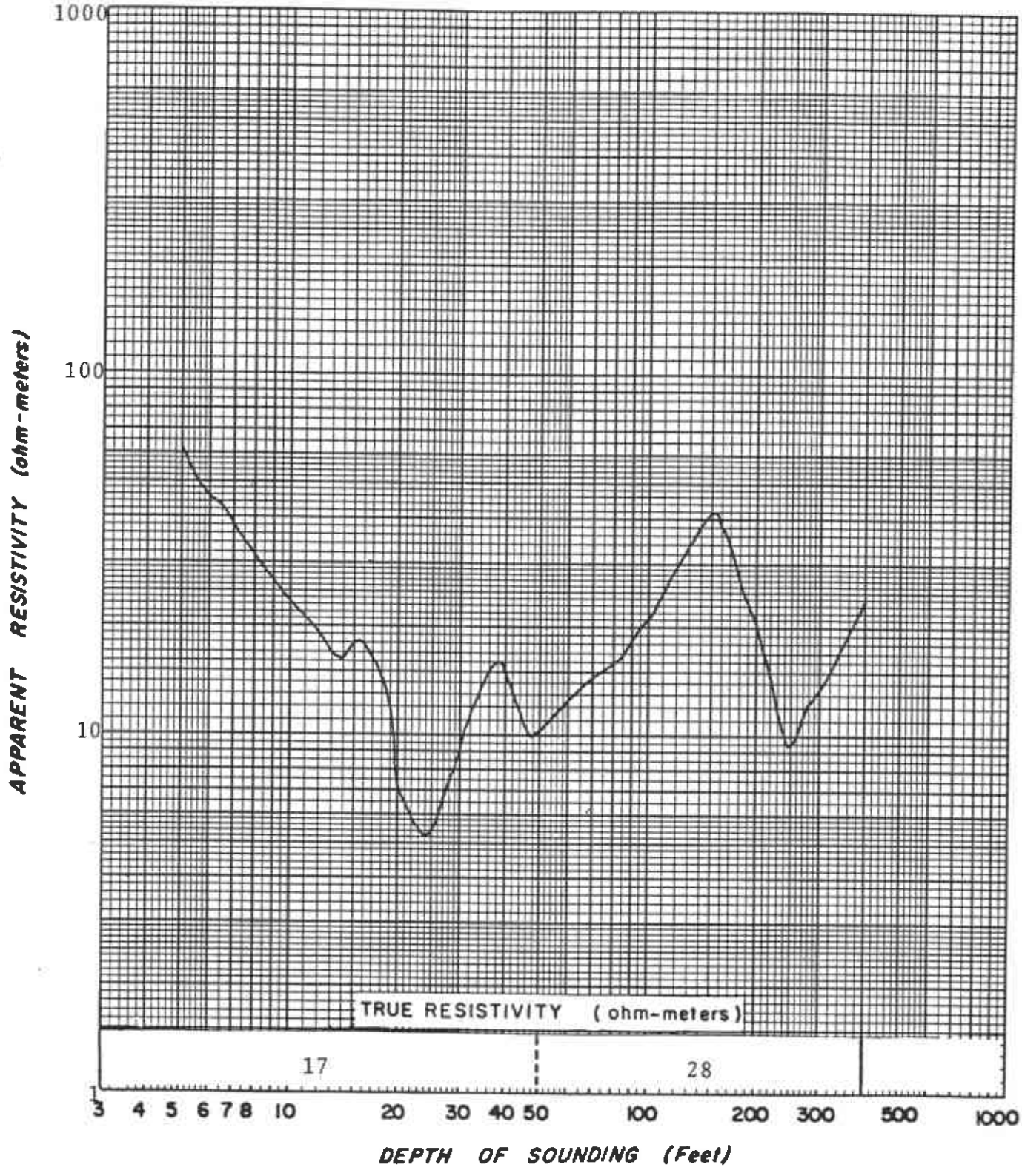
VERTICAL ELECTRICAL SOUNDING

VES-1

REDWOOD REGIONAL PARK

PROJECT NO. G413-01 **DATE:** 9-80 **FIGURE** 10



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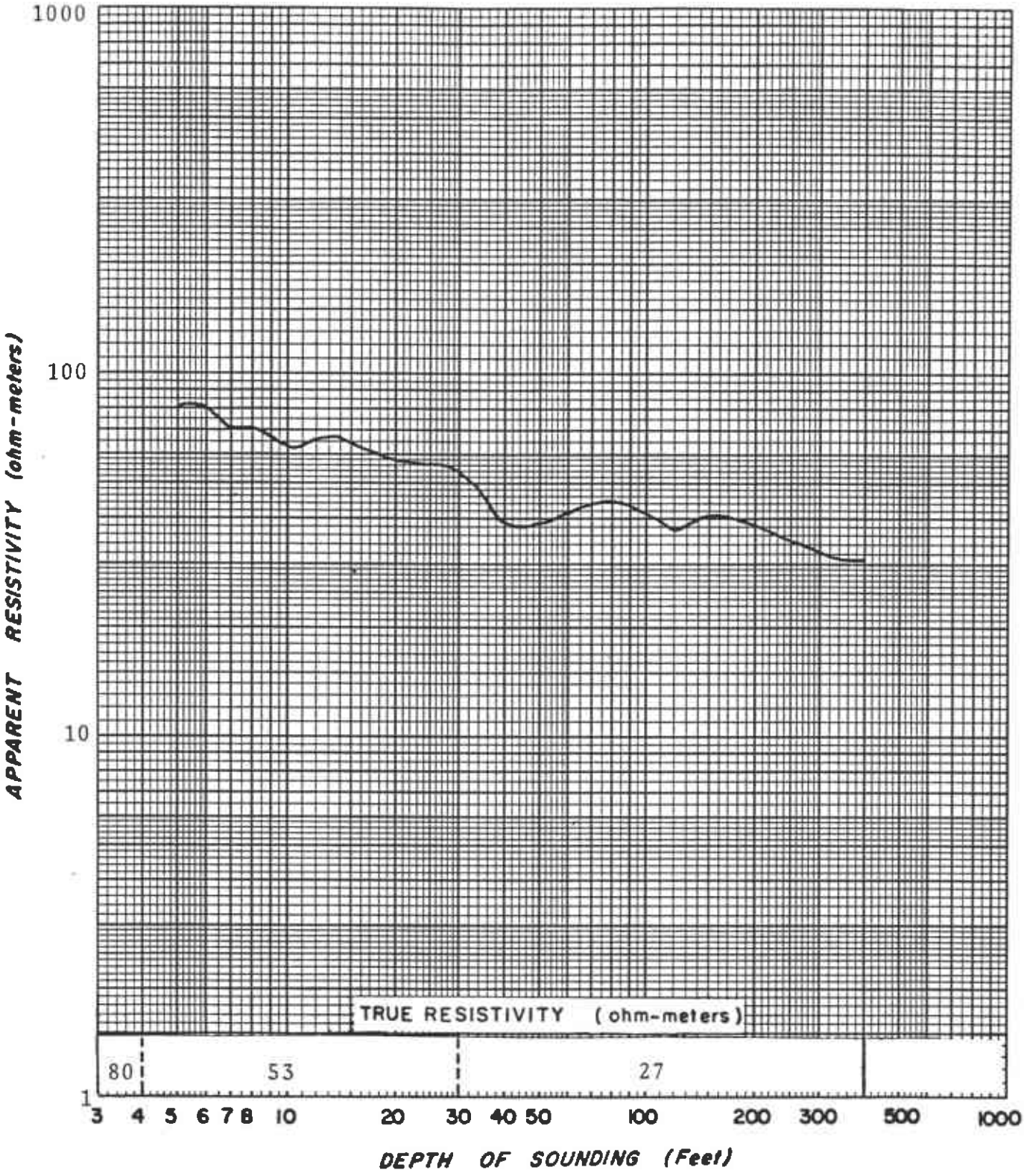
VERTICAL ELECTRICAL SOUNDING

VES-2

REDWOOD REGIONAL PARK

PROJECT NO. G413-01 **DATE:** 9-80 **FIGURE** 11



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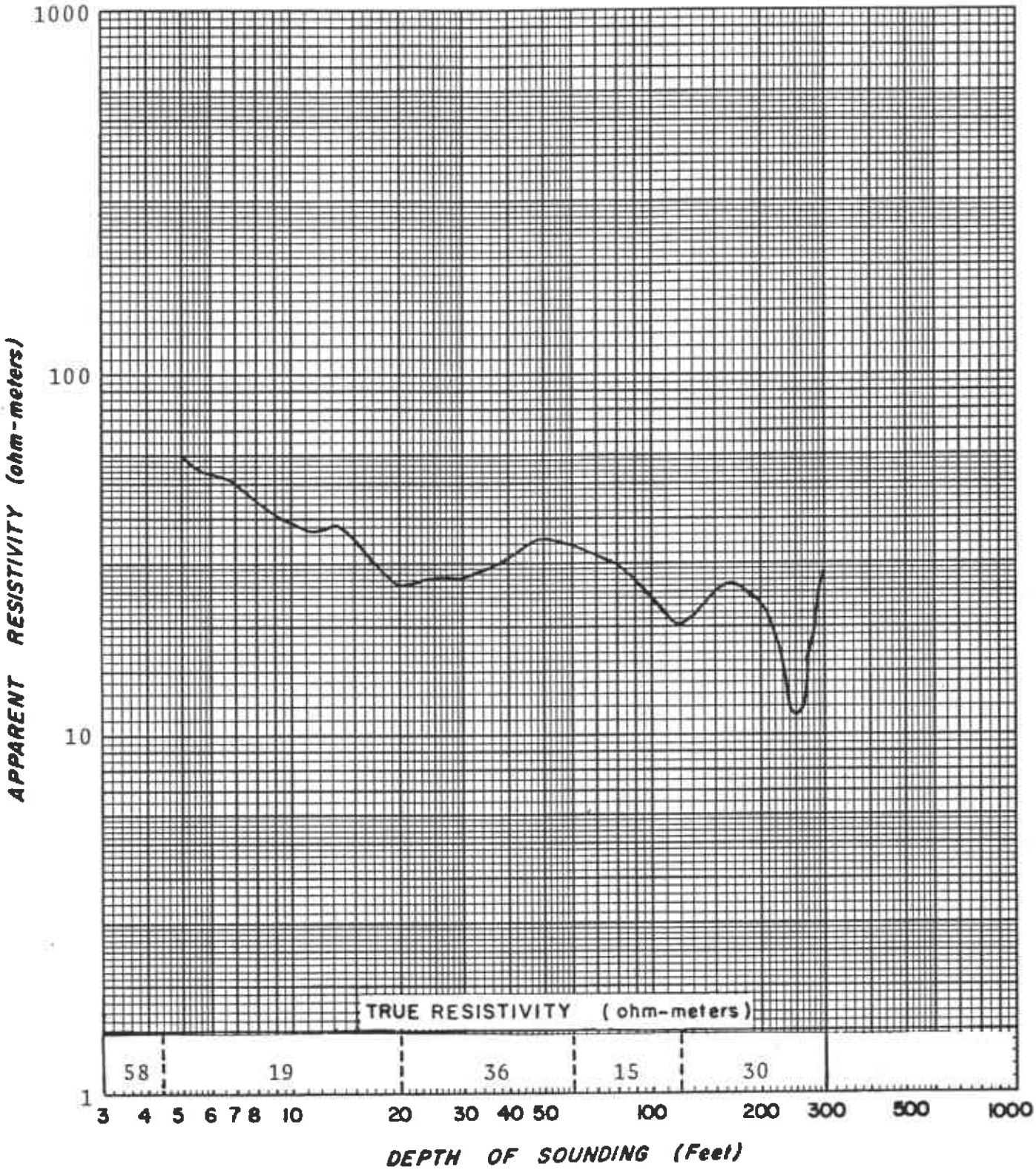
VERTICAL ELECTRICAL SOUNDING

VES-3

REDWOOD REGIONAL PARK

PROJECT NO. G413-01 **DATE:** 9-80 **FIGURE** 12



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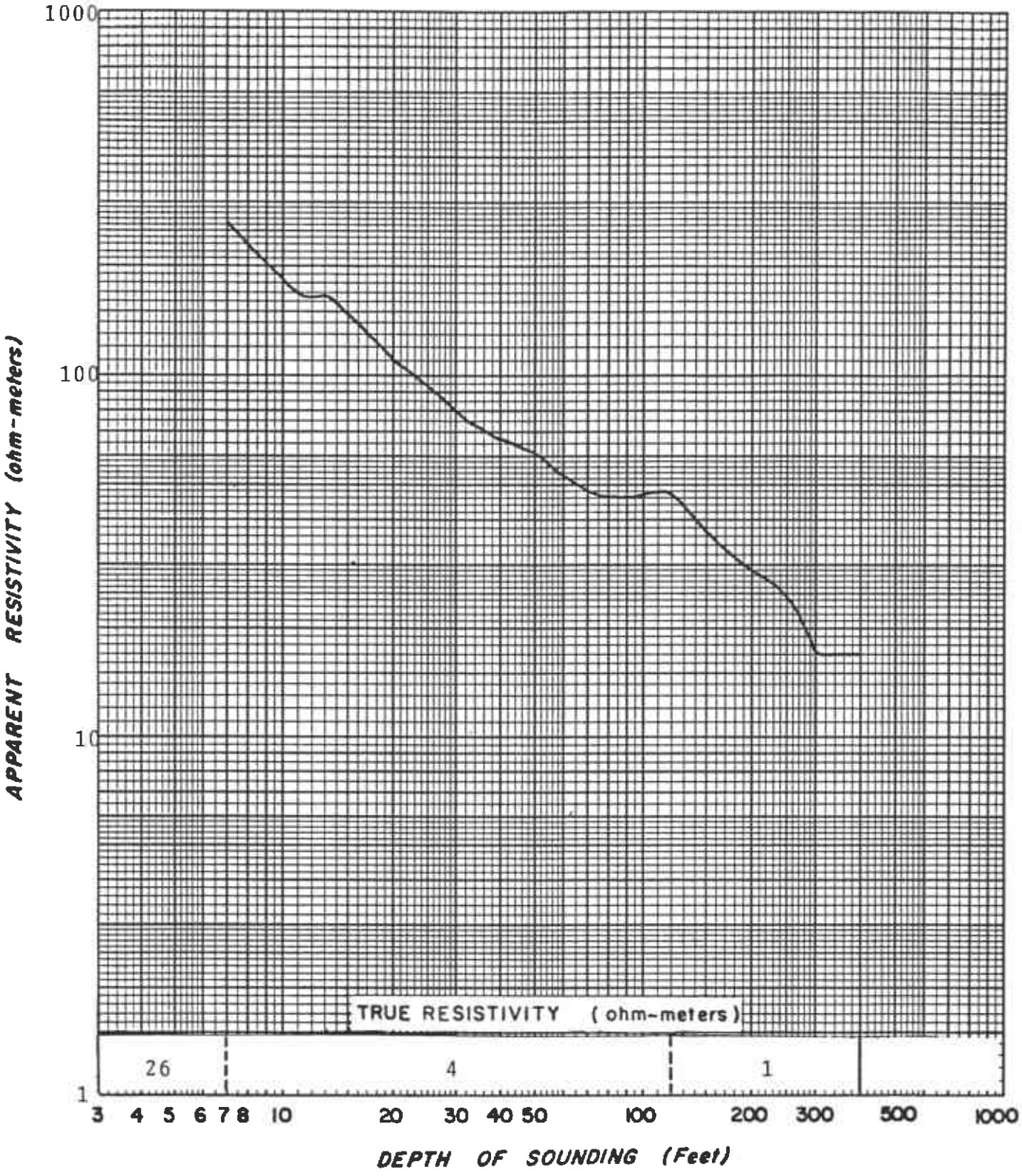
VERTICAL ELECTRICAL SOUNDING

VES-4

REDWOOD REGIONAL PARK

PROJECT NO. G413-01 **DATE:** 9-80 **FIGURE** 13



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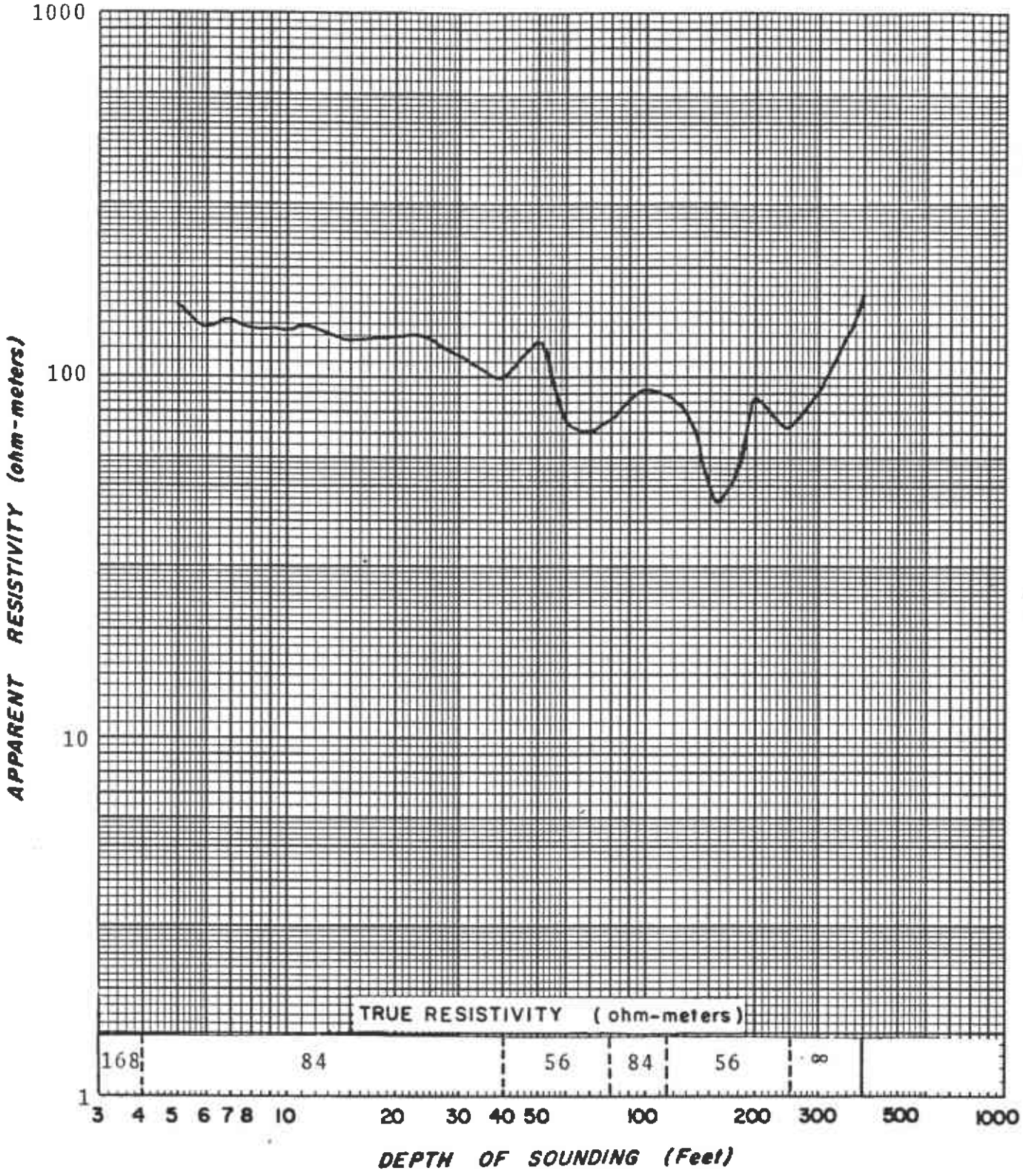
VERTICAL ELECTRICAL SOUNDING

VES-5

REDWOOD REGIONAL PARK

PROJECT NO. G413-01 **DATE:** 9-80 **FIGURE** 14



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VERTICAL ELECTRICAL SOUNDING

VES-6

REDWOOD REGIONAL PARK

PROJECT NO. G413-01 DATE: 9-80 FIGURE 15