516

REPORT ON

AN INDUCED POLARIZATION SURVEY

HIGHLAND VALLEY, B.C.

for

CANADIAN EXPLORATION LIMITED

by

HUNTING SURVEY CORPORATION LIMITED

AUGUST, 1963

CANADIAN EXPLORATION LIMITED

INDUCED POLARIZATION SURVEY OF THE BETTY LOU GROUP

EXPENSES INCURRED

CONTRACTING:	Hunting Survey Corp. Ltd., 9 survey days at $350.00/day as per invoice attached -	$3,150.00
LABOUR:	2 men as helpers on I.P. survey total 218 hours in 12 days as per invoice attached -	527.82
		$3,677.85

CCR/jh
15 October, 1963

C. C. Rennie, P. Eng.,
Geological Engineer.

CANEX AERIAL EXPLORATION LTD.
DIVISION OF
CANADIAN EXPLORATION LIMITED

No. 5618

TO
CANADIAN IMPERIAL BANK OF COMMERCE
Georgia & Burrard, Vancouver 5, B.C., Canada

VANCOUVER, B. C. October 2, 1963

PAY $3,150.00

TO THE ORDER OF

NORTHERN SUPPLY CORPORATION LIMITED,
[illegible] Dunlevy St.,
Vancouver 5, B.C.

CANEX AERIAL EXPLORATION LTD.

Negotiable without charge at any branch of Canadian Imperial Bank of Commerce in Canada, far Northern Branches excepted.

CANEX AERIAL EXPLORATION LTD.

THIS ATTACHED CHEQUE IS IN PAYMENT OF THE FOLLOWING ITEMS. PLEASE DETACH AND DEPOSIT CHEQUE ONLY.

Your Invoice # 1968 -- $ 3,150.00 CHQ.

ACCOUNTING DISTRIBUTION	DEBIT	CREDIT	
VENTURE 40 - Betty Lou Engineering and Contracting	3,150.00		VOUCHER PREPARED: RADEMAKER VOUCHER RECORD ENTERED PAYMENT APPROVED PAYMENT AUTHORIZED

INVOICE

HUNTING SURVEY CORPORATION LIMITED

1409 West Pender Street Vancouver 5 B.C. Canada • MUtual 3-6501 Cables: Canhunt

Canex Aerial Exploration Ltd.,
#700 - 1030 West Georgia Street,
Vancouver 5, B.C.

INVOICE No	1768
DATE	30th Sept. 1963
YOUR ORDER No	P.O. E 1804
JOB No	63-170
TERMS: NET CASH	
SHIPPED VIA	

QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
	TO:		
	Progress: Induced Polarization Survey over the Betty Lou Group, West of Craigmont Mines Ltd.		
	Field work complete, final report to be delivered: Say, 75% complete		$3,150.00

E 1804
L. ADLE
DATE
CHECKED WITH
APPROVED FOR
CHARGED TO V40 Betty Lou

Eng. Contractor

INTEREST MAY BE CHARGED ON OVERDUE ACCOUNTS

CANEX AERIAL EXPLORATION LTD.
DIVISION OF
CANADIAN EXPLORATION LIMITED

No 5588

TO
CANADIAN IMPERIAL BANK OF COMMERCE
Georgia & Burrard, Vancouver 5, B.C., Canada

VANCOUVER, B. C. October 4, 1968

PAY $527.85

TO THE ORDER OF

CRAIGMONT MINES LIMITED

CANEX AERIAL EXPLORATION LTD.

Negotiable without charge at any branch of Canadian Imperial Bank of Commerce in Canada, for Northern Branches ex

CANEX AERIAL EXPLORATION LTD.

THIS ATTACHED CHEQUE IS IN PAYMENT OF THE FOLLOWING ITEMS. PLEASE DETACH AND DEPOSIT CHEQUE ONLY.

YOUR INVOICE # 398 -- $527.85 CHQ.

ACCOUNTING DISTRIBUTION	DEBIT	CREDIT	
VENTURE 40 Betty Lou Property Expense	527.85		VOUCHER PREPARED RADEMAKER VOUCHER RECORD ENTERED PAYMENT APPROVED PAYMENT AUTHORIZED

Form 98

CRAIGMONT MINES LIMITED

Invoice No. 398

TO: CANEX AERIAL EXPLORATION LTD.,
700 Burrard Bldg.,
Vancouver, B. C.

VANCOUVER, B.C.

Date	Particulars	Amount

LABOUR RE: I.P. Survey on Betty Lou

MINERAL CLAIMS.

	REG. HOURS	O.T. HOURS
9 August, 1963	16	4
10	8	12
12	16	
13	1.6	2
15	16	
17		17
19		9
20	16	4
21	16	4
22	16	4
23	3.6	4
24	8	14
	144	74

144 Hours @ $1.80/HR.	259.20
74 Hours @ 2.70/HR.	199.80
15% Overhead	68.85
$	527.85

ORDER NO.
RECEIVED BY
DATE
CHECKED WITH ORDER
EXTENSIONS & CASTS
PRICE APPROVED
APPROVED FOR PAYMENT
CHARGED TO W/O Betty Lou PROPERTY XP.

Payment of the ove amount should be made to this Company's Head Office at:

0 Burrard Building
1030 West Georgia St.
Vancouver 5, B.C.

A copy of this Account should accomp payment.

26th September, 1963

Chief Accountant

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APPENDIX:

Profiles: Lines 66+00W, 68+00W, 70+00W, 72+00W, 74+00W, 76+00W, 78+00W, 80+00W, 82+00W. **Scale: 1 inch to 100 feet**

ACCOMPANYING MAPS: **MAP POCKET**

1 **Interpretation Map - Scale 1 inch to 100 feet**

2 **I.P. Survey - Apparent Chargeability Contour Map**

Scale: 1 inch to 100 feet

3 **- Apparent Resistivity Contour Map**

Scale: **1 inch to 100 feet**

4 Claim Location Map - Scale 1 inch to 2 miles

Betty Lou and Loo Claims Map - Scale 1 inch to 1000 feet

INTRODUCTION

From August 9th to 24th, 1963, an Induced Polarization (I. P.) survey was carried out by Hunting Survey Corporation Limited over part of the Betty Lou Property, owned by Canadian Exploration Limited.

This group of Mineral Claims is situated in the Highland Valley, about 12 miles from Merritt, B.C. The survey extended over the following mineral claims:

Betty Lou No. 11	Betty Lou No. 13
Betty Lou No. 12	Betty Lou No. 3 Fraction

The survey was performed by a four-man crew. The project geophysicist in charge of the survey and the operator were P.E. Walcott and W. Mairs respectively, of Hunting Survey Corporation Limited. Canadian Exploration Limited provided L. Overton and D. Tiffin as assistants.

The geophysical survey was carried out along pre-cut and chained picket lines. The lines surveyed lie in a north-south direction and are designated by the numbers 82, 80, 78, 76, 74, 72, 70, 68 and 66. This grid system provided a total of 18,000 feet or approximately 3 1/2 miles. The basic coverage of the survey consisted of readings at 100-foot intervals along the grid system described.

Two electrode configurations were used in obtaining the data, i.e., the "gradient array" and the "three electrode array".

The gradient array consists of two current electrodes (C_1 and C_2) placed a large distance apart, approximately 2 "a" feet. Two potential electrodes (P_1 and P_2) are placed a distance "S" apart approximately in the survey lines. The current electrodes are fixed and the potential electrodes are moved in unison with 100-foot jumps. With the current electrodes fixed as described, a relatively uniform field region in which the measurements are taken covers a block approximately "a" feet square. The centre point of this block coincides with the mid-point of an imaginary line joining C_1 and C_2. Measurements are taken on lines parallel to the above mentioned imaginary line in the block described.

Primary and secondary voltages are measured as will be discussed later in the description of the equipment. The values are plotted against the mid-point of $P_1 - P_2$.

The gradient array electrode configuration retains a high degree of resolution for small bodies, has good depth penetration and offers certain, practical operational advantages. It has no "depth control" but its results are relatively easy to interpret, being similar to horizontal magnetic field anomaly forms.

Assuming that we are working in a region of uniform, horizontal current flow, the interpretation of results becomes relatively straightforward. The peaks of anomalies lie generally directly above the causative sources. Dipping bodies give asymmetric curves with a gradual build-up on the hanging-wall side and a sharper fall-off on the foot-wall side. For very flat dips negative chargeabilities may even appear on the foot-wall side.

Depth estimates with this array must be made by curve shape interpretation. Once an anomaly has been located it may be detailed by profiles of a closed coupled array using different spacings. The three-electrode array is a closed coupled array.

The three-electrode array consists of one current electrode (C_1) and two potential electrodes (P_1 and P_2). The second current electrode (C_2) remains fixed at "infinity" while C_1, Pl and P_2 are moved in unison, all in 100-foot, or less, jumps along the line. The values are plotted against the mid-point of Cl and P_1.

The gradient array electrode configuration was used over the whole survey area to quickly detect the presence of mineralization, and the three-electrode array was used at spacings of 25, 50, 100 and 200 feet to detail an anomaly on Line 68. For the gradient array survey the locations of the current electrodes C_1 and C_2 were 73+00W, 53+00N and 12+00N, respectively.

The Hunting pulse-type instrument is similar in design and operation to those described by R. W. Baldwin, in "A Decade of Development in Overvoltage Supply", A. I. M. E. Transactions, Vol. 214, 1959. Power is obtained from a 115 volt, 400 cycle three-phase inverter driven by a 28 volt d. c. generator, providing a maximum of 2. 5 kw d. c. to the ground. The cycling rate is 1. 5 seconds "current on" and 0. 5 seconds "current off", the pulses reversing continuously in polarity. The data collected in the field consists of careful measurement of the current (I) in amperes flowing through electrodes Cl and C2, the primary voltage (V_p) appearing between P_1 and P_2 during the "current on" part of the cycle, and the secondary or overvoltage appearing between P_1 and P2 during the "current off" part of the cycle. Both of these voltages are measured in volts. The "apparent chargeability" (Ma) in milliseconds is calculated by dividing the polarization (V_s) by the primary voltage (V_p) and multiplying by 400 which is the sampling time in milliseconds of the receiver unit. The "apparent resistivity" in ohm-motcrs is proportional to the quotient of the primary voltage (V_p) and the measured current (I), the proportionality factor depending on the geometry of the array used. The resistivity and chargeability obtained are called "apparent" as they are values which that portion of the earth sampled by the array must have if it were honogeneous. As the earth sampled is usually inhomogeneous, the calculated "apparent resistivity" and "apparent

chargeability" are functions of the "true chargeability and resistivity" of the various portions of the earth sampled and of the geometry of these portions.

The results of this survey and their interpretation are shown on individual profiles at the end of this report. These profiles have a horizontal scale of one inch to 100 feet. The "apparent chargeability" is plotted on a vertical scale of 2.0 milliseconds per inch. The "apparent resistivity" is plotted at a vertical logarithmic scale of two inches per logarithmic cycle. The interpretation, as determined from both the three-electrode array and gradient electrode array configurations, is presented on a map at a scale of one inch to 100 feet. Two other maps are presented with this report; these show in plan form a contour presentation of the data obtained by the gradient electrode array configuration. The "apparent chargeability" map has a contour interval of one millisecond, and the "apparent resistivity" map a contour interval of 100 ohm meters. These maps are also at a scale of one inch to 100 feet.

This report constitutes the final interpretation of the survey and revises in some respects the preliminary interpretation previously submitted.

INTERPRETATION PROCEDURES

Due to the geometry of the mineralized zones which are the target of I. P. surveys in the Highland Valley, the usual approach to quantitative interpretation assuming a horizontally layered earth can seldome be applied. The complex problem of the combined effects of depth of burial (h), width, dip and true chargeability (M2) of a vertically mineralized zone plus the physical characteristics of the overburden and country rock have not been solved exactly. However, certain rules-of-thumb plus experience gained from test surveys over known ore bodies permit certain estimates to bc made.

The maximum possible width of the causative bodies are indicated on the accompanying profiles, with the provision that the body is probably narrower than indicated. Rough depth estimates are made in some cases.

The interpretation of the survey data consists of a careful analysis of each individual profile. The results of this analysis are shown by appropriate symbols on the I. P. profiles. Those results are also transferred to the interpretatinn map using the same symbols.

The symbols used are as follows: the "cross-hatched" symbol is used to represent "zones of special interest", while the "single-hatched" symbol indicates "zones of possible interest", i.e., anomalous zones which cannot be broken into individual bodies, or zones which show lower chargeability or greater depth.

Estimated depths (h) are shows in feet. It should be noted that these depths would be more properly called distances to the body, the distances being measured in a plane perpendicular to the line and to the ground surfaces. This is due to the fact that the I. P. method samples a certain volume of the earth and, therefore, the causative bodies do not necessarily lie beneath the lines surveyed but could be located to one or the other side of the line. Such a condition is called a "side-effect".

Values of true chargeability (M_2) of the causative bodies have been shown in some cases. These have been derived by simple, empirical relationships which take into account the solid angle subtended by the body at the ground surface. It is noted that the narrower bodies show the highest true chargeabilities. This may be partly because the values over the wider bodies are averages of richer and leaner mineralization. Zones of high chargeability may exist within the broader bodies.

The relationship between percentage sulphide and true chargeability is quite variable, but a range of between 0.17% to 0.5% per millisecond may be expected in this case.

INTERPRETATION

The final interpretation differs in detail only with the preliminary interpretation submitted earlier, In particular, the limits of the bodies have been revised, together with the numbering thereof. Zones 1 to 5 have been replaced by two mineralized bodies, each striking approximately east-west across the area. These are referred to as the North body and the South body in this report.

The North body varies in width from 250 to 600 feet and in depth from 80 to 225 feet. The widths, as previously explained, arc the probable outer limits of mineralization. One zone of high chargeability occurring within the North body is shown cross-hatched for special emphasis. This zone varies from 170 to 280 feet in width and from 80 to 130 feet in depth. Depths represent the depths to what is believed to be the level of most concentrated mineralization. On some lines there is evidence that minor amounts of mineralization come much closer to surface. The North body extends completely across the survey area, discontinuation being the result, it is thought, of faulting in a north-south direction. True chargeability of the body varies from 4. 7 to 20 milliseconds, indicating a probable range of sulphide mineralization of from 0.8% to 10% by volume. In the more concentrated zone on Lines 66tOOW to 72+00W, the average percentage is believed to be between 2% and 10% by volume. In the centre part of the North body from Lines 74tOOW to 80+00W, the average concentration is most probably in the range 1% to 3% by volume,

locally varying both above and below this range,

The South body appears to be much narrower and shorter in strike length, though its eastern limit is not defined. Width varies from 100 to 150 feet, depth from 45 to about 100 feet. True chargeability estimates are not reliable but show a probable range of from 4. 5 to 7. 0 milliseconds. Sulphides may therefore be present in the amount 0.8% to 3. 5% by volume.

Ncithcr of the above bodies has a definite correlation with the magnetic or rssistivity patterns. The strike is not inconsistent with known geology and the interpreted faulting pattern appears to be structurally reasonable. The faults also show good correlation with discontinuities in the major magnetic trends.

The survey area is shown geologically as underlain by greywacke, with minor exposures of andesite tuff and quartz andesitc. This picture is not consistent with the rather pronounced relief exhibited by the magnetic contours . Instead, it would appear more probable that volcanics and/or intrusives are fairly abundant in the survey area.

A regional increase in chargeability is observed towards the south limit of t'he area. This coincides with the broad anomaly exhibited on the reconnaissance survey of 1961 and is believed to be caused by widespread pyrite mineralization in the limestones and other rocks lying immediately to the south of the detail area. The North and South bodies could have the same cause. The South body truncates at its west end

near to an exposure of limestone. The North body lies close to an outcrop of greywacke which, according to reports, contains pyrite.

On the basis of the I.P. survey it is not possible to identify the type of mineralization present. It is therefore recommended that three diamond drill holes be placed to sample the more favourable regions of the two bodies. These holes are shown on the interpretation map but for convenience are also listed below:

Hole No. 1 Line 68+00W, 33+00N, south along the picket-line with dip 60°, total length 600 feet.

Hole No. 2 Line 76+00W, 27+00N, north along the picket-line with dip 60°, total length 1000 feet.

Hole No. 3 Line 72+00W, 23+75N, south along the picket-line with dip 60°, total length 400 feet.

The results of this survey are quite consistent with those of the 1961 survey, particularly with regard to Line 78tOOW. On this line, the single body now shown coincides almost exactly with the double zone indicated by the earlier survey. On Line 68tOOW the series of zones interpreted by the earlier survey now shows as two bodies, the north body lying bctwaen two of the 1961 zones. In this case the earlier interpretation is believed *to* have been confused by the double-peak effect obtained when the three-electrode array is used over shallow bodies. It shows the advantage of the gradient array in situations of this sort.

SUMMARY AND RECOMMENDATIONS

Two mineralized bodies are interpreted on the basis of this detail I. P. survey. The North body is believed to contain sulphidcs in average concentration 1% to 3%, with zones up to 200 feet wide with a maximum concentration of 10% by volume. The South body is narrower and has sulphides in the range 0.8% to 3.5% on the average.

The mineralization is not identified but the proximity of pyrite in outcrops and the lack of magnetic response suggests that disseminated pyrite may be the cause.

To sample these bodies, three diamond drill holes are recommended. Trenching on Line 68tOOW may indicate mineralization but will not reach the level of maximum concentration.

No further geophysics is recommended in this detail area.

HUNTING SURVEY CORPORATION LIMITED,

Peter E. Walcott,
Project Geophysicist.

Norman R. Paterson, P. Eng.,
Chief Geophysicist.

APPENDIX

V

I I? PROFILES : L ines - 66tO0 W

68tO0 W

70+00 w

72too w

74too w

76tO0 W

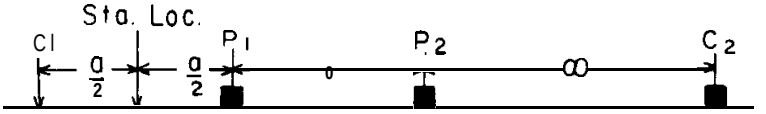
78+00 W

80tO0 W

82tOOW

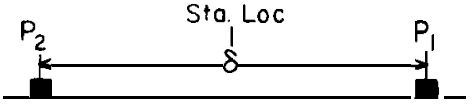
3-ELECTRODE ARRAY

V



Line 68tO0 W

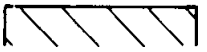
GRADIENT ARRAY



Lines 66tO0 W - 82+00 W incl.

INTERPRETATION LEGEND

• • • Zone of concentrated mineralization



• • • • • • • • • Zone of weak mineralization

h = 100' • • -- • • • • • • • • • Depth to top of body

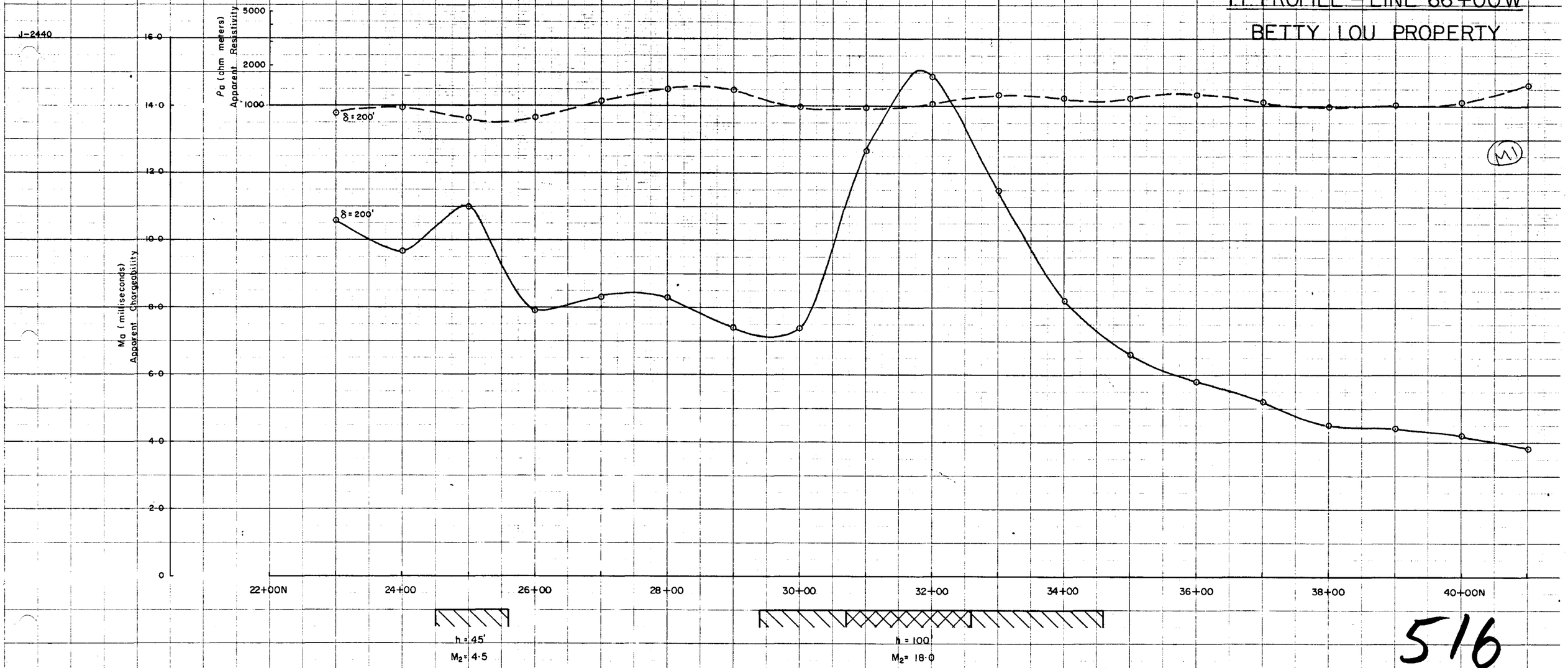
W

M_2 = 20·0 • • • • • • • • True chorgeobility of body

I.P PROFILE – LINE 66+00W

BETTY LOU PROPERTY

J-2440

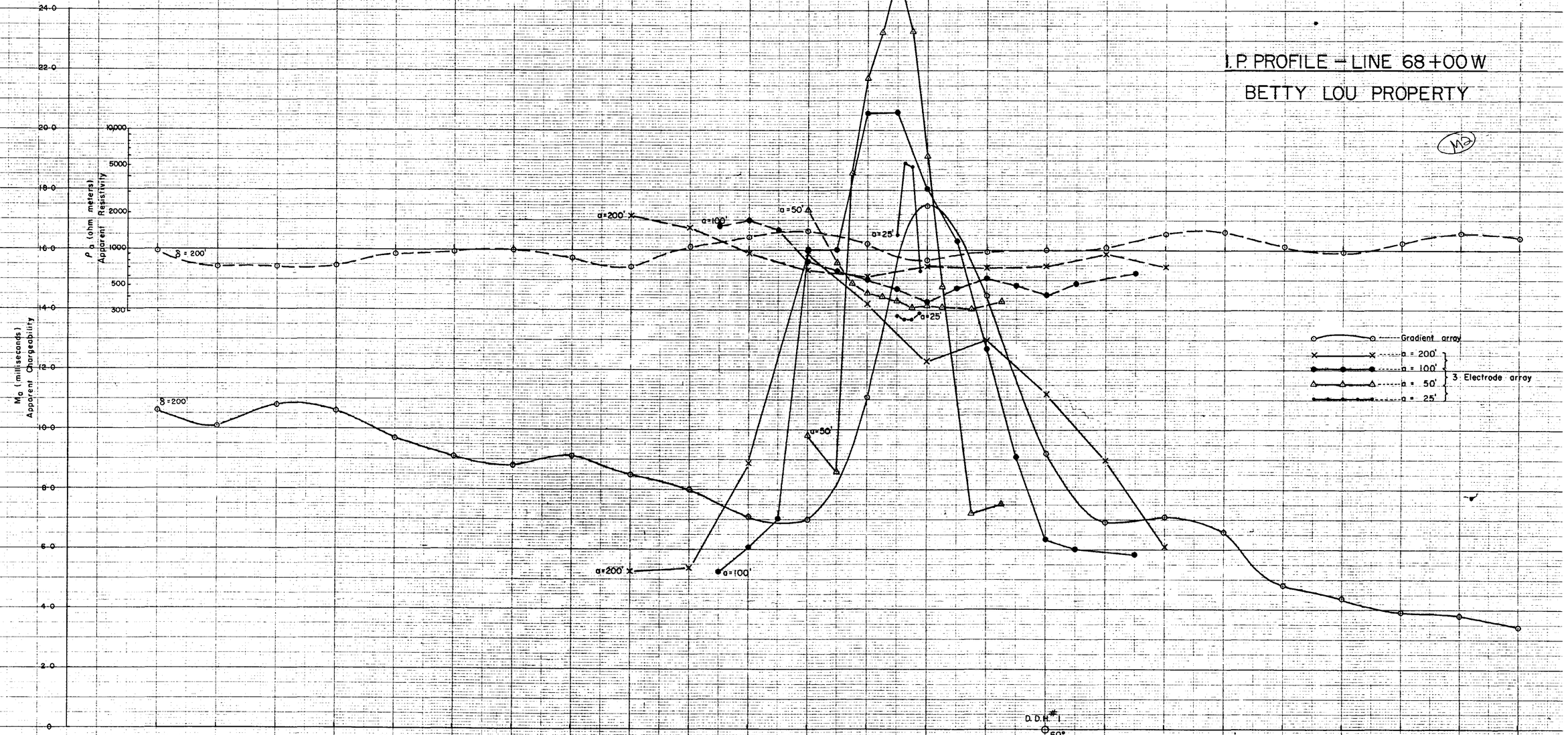


516

J-2440

I.P. PROFILE – LINE 68+00W

BETTY LOU PROPERTY

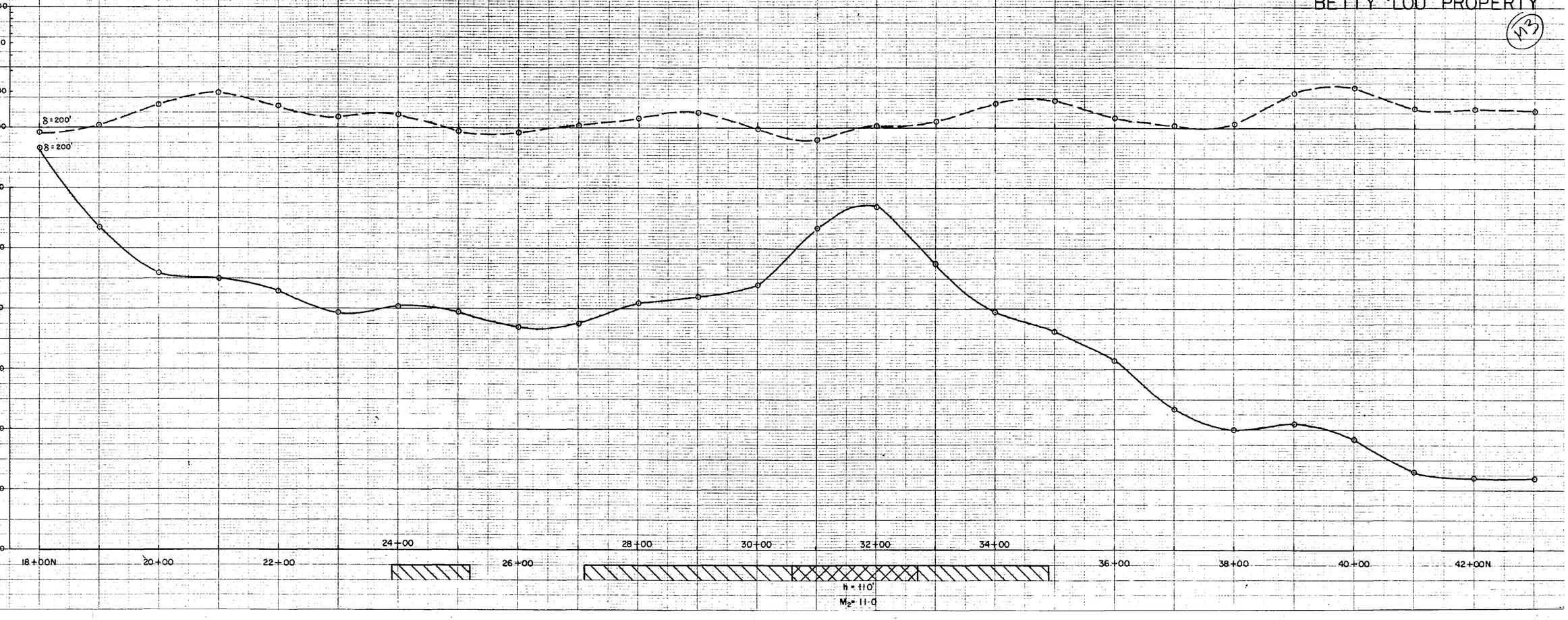


I.P PROFILE – LINE 70+00W

BETTY "LOU PROPERTY

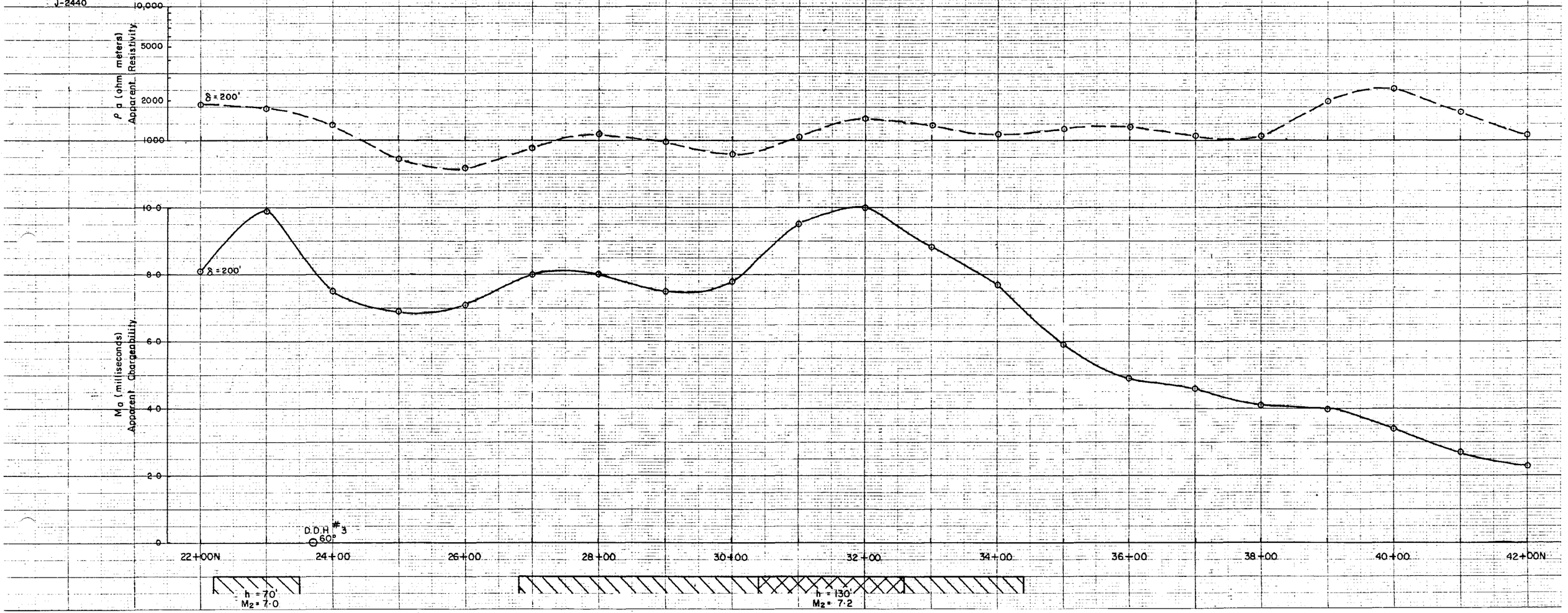
(43)

J-2440



I.P PROFILE – LINE 72+00W

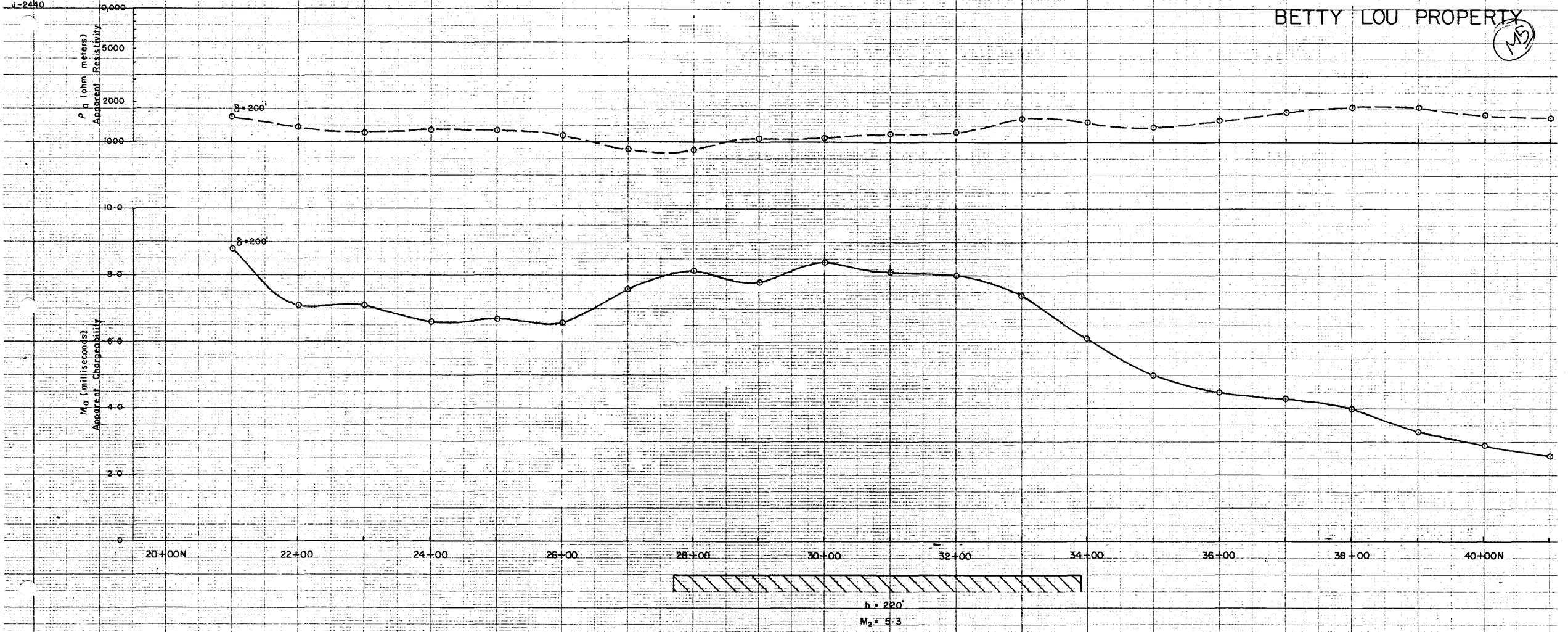
BETTY LOU PROPERTY



I.P. PROFILE – LINE 74+00W

BETTY LOU PROPERTY

J-2440

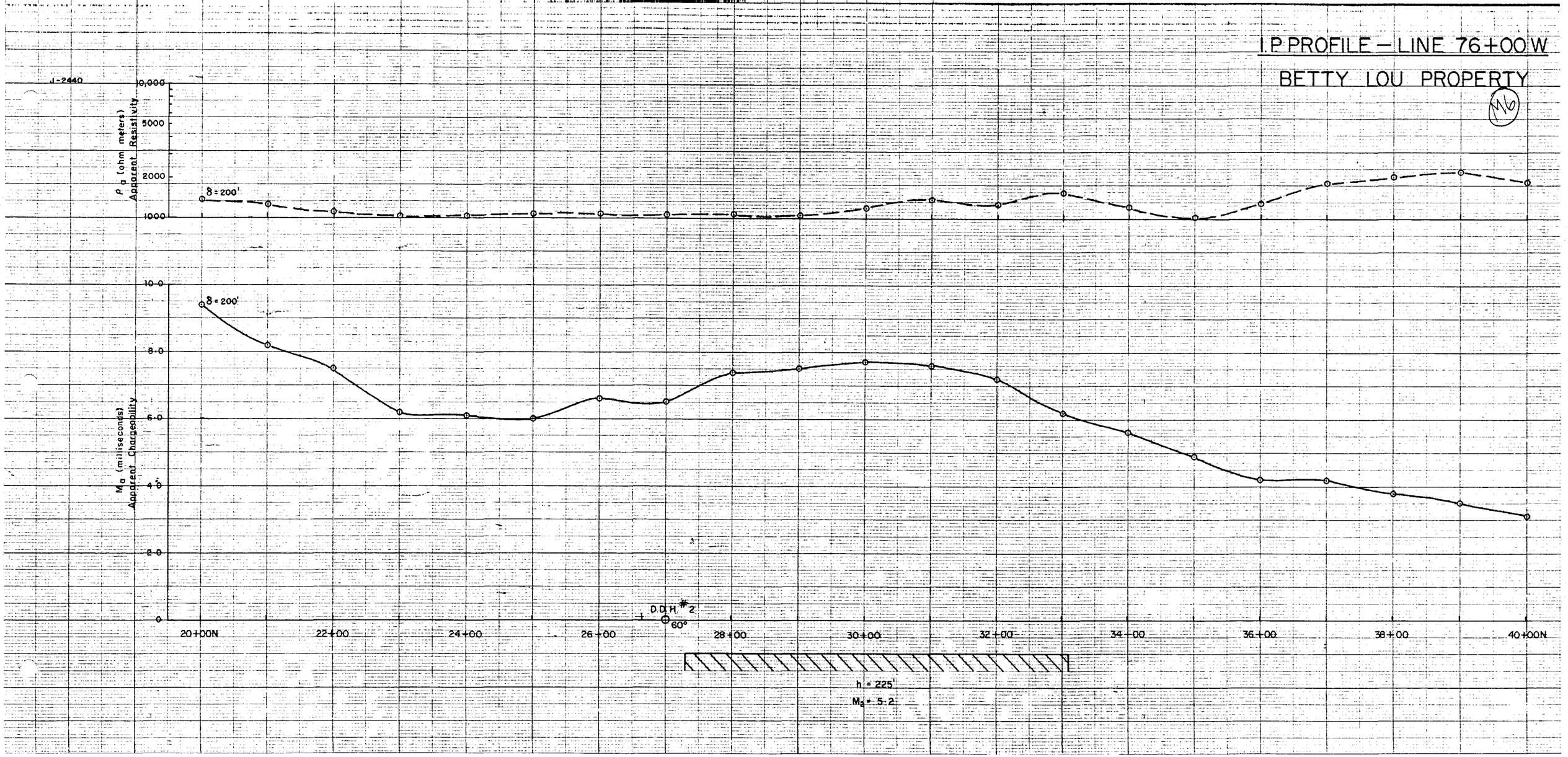


I.P PROFILE — LINE 76+00W

BETTY LOU PROPERTY

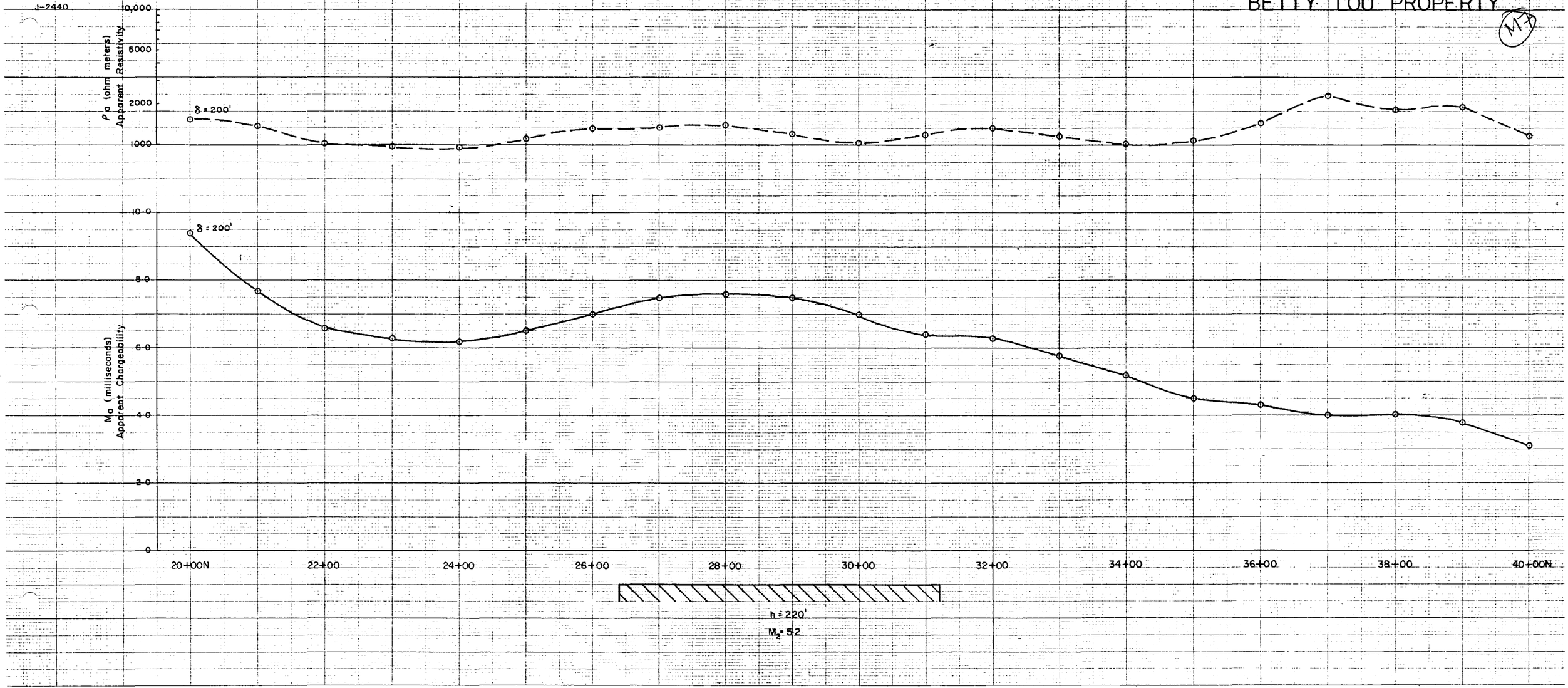
(MB)

J-2440



I P PROFILE – LINE 78+00W

BETTY LOU PROPERTY

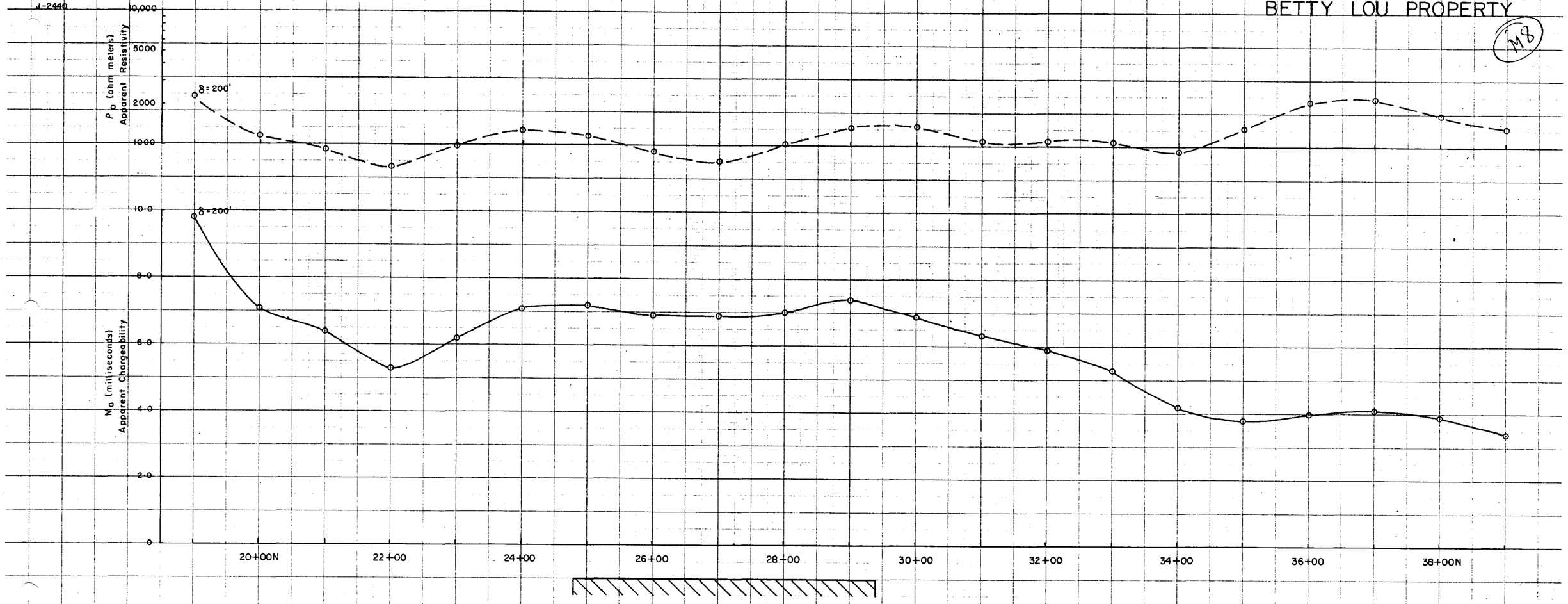


I P PROFILE – LINE 80+00W

BETTY LOU PROPERTY

M8

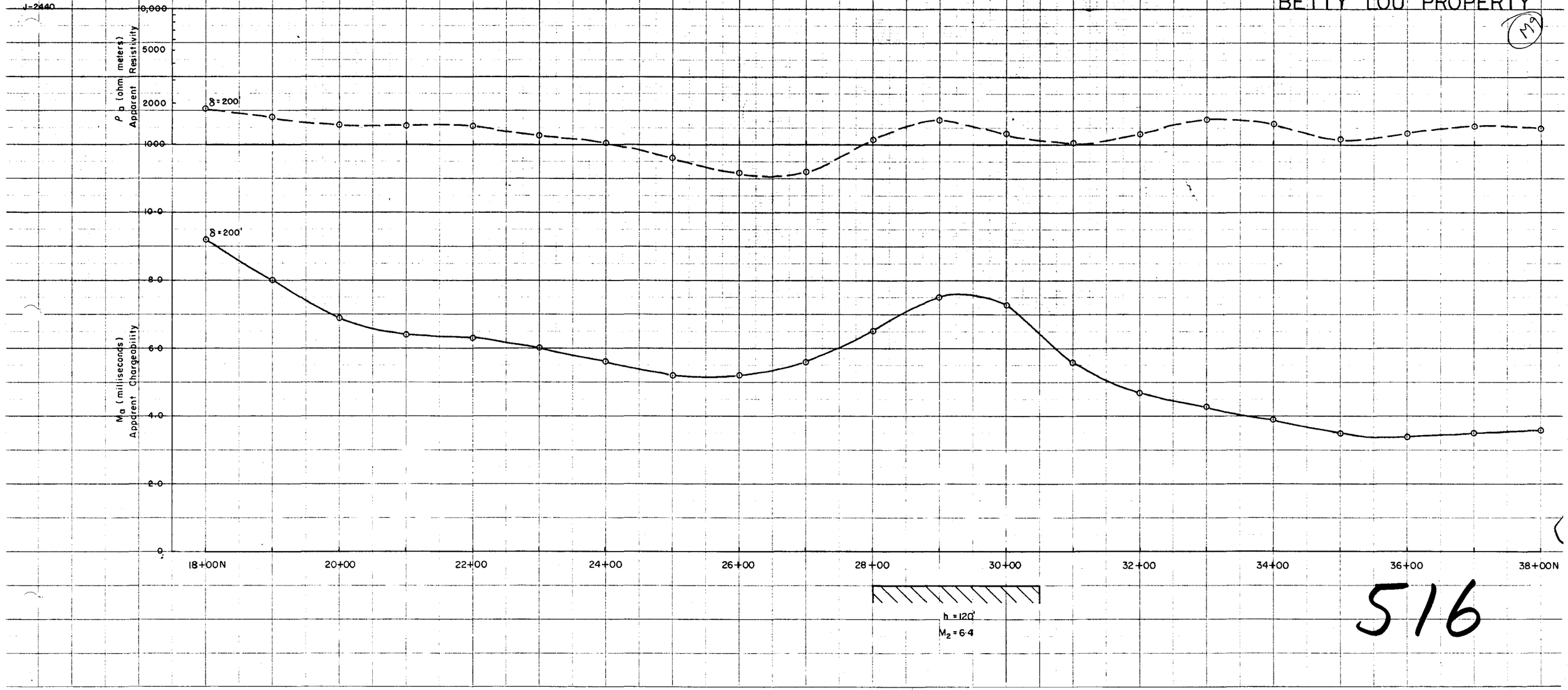
J-2440



I.P PROFILE – LINE 82+00W

BETTY LOU PROPERTY

J-2440



516

L. 82+00 W | L. 80+00 W | L. 78+00 W | L. 76+00 W | L. 74+00 W | L. 72+00 W | L. 70+00 W | L. 68+00 W | L. 66+00 W

42+00 N
40+00 N
38+00 N
36+00 N
34+00 N
32+00 N
30+00 N
28+00 N
26+00 N
24+00 N
22+00 N
20+00 N
18+00 N

BETTY LOU 12

BETTY LOU 14

BETTY LOU 3 FR.

BETTY LOU 13

BETTY LOU 11

D.D.H. #1 60°
h = 130' M_2 = 7·2
h = 110' M_2 = 11·0
h = 100' M_2 = 20·0
h = 100' M_2 = 18·0

D.D.H. #2 60°
h = 225' M_2 = 5·2
h = 220' M_2 = 5·3
h = 120' M_2 = 6·4
h = 220' M_2 = 5·2

D.D.H. #3 60°
h = 70' M_2 = 7·0
h = 45' M_2 = 4·5

N

LEGEND

- Zone of concentrated mineralization
- Zone of weak mineralization
- h = 100' ..... Depth to top of body
- M_2 = 20·0 ..... True chargeability of body
- Fault
- Strike and dip of bedding
- Strike and dip of mineralized zone
- Diamond Drill Hole

CANADIAN EXPLORATION LIMITED

INDUCED POLARIZATION SURVEY
BETTY LOU PROPERTY
HIGHLAND VALLEY, B.C.

INTERPRETATION

SCALE : 1 inch = 100 feet

HUNTING SURVEY CORPORATION LIMITED, TORONTO, CANADA – SEPTEMBER, 1963.

Norman R. Paterson, Chief Geophysicist

J-2440

M11

L-82+00 W | L-80+00 W | L-78+00 W | L-76+00 W | L-74+00 W | L-72+00 W | L-70+00 W | L-68+00 W | L-66+00 W

42+00 N
40+00 N
38+00 N
36+00 N
34+00 N
32+00 N
30+00 N
28+00 N
26+00 N
24+00 N
22+00 N
20+00 N
18+00 N

N

BETTY LOU 12

BETTY LOU 14

BETTY LOU 3 FR.

BETTY LOU 11

BETTY LOU 13

CANADIAN EXPLORATION LIMITED

INDUCED POLARIZATION SURVEY
BETTY LOU PROPERTY
HIGHLAND VALLEY, B.C.
APPARENT CHARGEABILITY
GRADIENT ELECTRODE ARRAY

CONTOUR INTERVAL : 1·0 milliseconds SCALE : 1 inch = 100 feet

HUNTING SURVEY CORPORATION LIMITED, TORONTO, CANADA - SEPTEMBER, 1963.

Norman R. Paterson, Chief Geophysicist

J-2440

2

M12

L-82+00 W | L-80+00 W | L-78+00 W | L-76+00 W | L-74+00 W | L-72+00 W | L-70+00 W | L-68+00 W | L-66+00 W

42+00 N
40+00 N
38+00 N
36+00 N
34+00 N
32+00 N
30+00 N
28+00 N
26+00 N
24+00 N
22+00 N
20+00 N
18+00 N

BETTY LOU 12

BETTY LOU 3 FR.

BETTY LOU 14

BETTY LOU 11

BETTY LOU 13

N

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 516 MAP 3

CANADIAN EXPLORATION LIMITED

INDUCED POLARIZATION SURVEY
BETTY LOU PROPERTY
HIGHLAND VALLEY, B.C.
APPARENT RESISTIVITY
GRADIENT ELECTRODE ARRAY

CONTOUR INTERVAL: 100 ohm meters SCALE: 1 inch = 100 feet

HUNTING SURVEY CORPORATION LIMITED, TORONTO, CANADA - SEPTEMBER, 1963.

Norman R. Paterson, Chief Geophysicist

J-2440

(M13)

BETTY LOU M.C.'s

CARIBAMONT

PROMONTORY HILL LOOKOUT

LOO CLAIMS

N

NICOLA RIVER

MERRITT

COLDWATER RIVER

CLAIM LOCATION MAP

SCALE: 1" = 2 MILES.
DATE: 17 OCT. 1963
DRAWN: W. PENTLAND

50°00'
121°00'

Betty Lou Group
Merritt, B.C.
Sketch of Claims
Drawn by: A.A. Traced by: S. W.
SCALE: 1" = 1,000'
October 16, 1963

BETTY LOU #10
BETTY LOU #12
BETTY LOU #14
BETTY LOU #2 FRAC
BETTY LOU #9
BETTY LOU #3 FRAC
BETTY LOU #11
BETTY LOU #13
BETTY LOU #7 FRAC
BETTY LOU #1 FRAC.
BETTY LOU #6 FRAC.
LOO #8 FRAC
BETTY LOU #2
BETTY LOU #4
BETTY LOU #6
BETTY LOU #8
BETTY LOU #1
BETTY LOU #4 FRAC
BETTY LOU #3
BETTY LOU #5
BETTY LOU #7
TOM #B-3
TOM #B-4
LOO #7 FRAC
TOM #5 FRAC.
TOM #7 FRAC

Willy Group

WILLY #3 FRAC
WILLY #3
WILLY #2
WILLY #1
LOO #6
LOO #4
LOO #2
HAR #8
LOO #5
LOO #3
LOO #1
WEST #8