669

REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE J. W. CLAIM GROUP JACK WILSON CREEK AREA FOR KENNCO EXPLORATIONS (WESTERN) LTD.

104G/4E

BY

PHILIP G. HALLOF, Ph. D.

NAME AND LOCATION OF PROPERTY:

J. W. CLAIM GROUP, JACK WILSON CREEK AREA

LIARD MINING DIVISION, B. C. 57°/131° S. W.

DATE STARTED: July 17, 1965

DATE COMPLETED: July 30, 1965

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NOTES ON THE THEORY OF INDUCED POLARIZATION AND THE METHOD OF FIELD OPERATION

Induced Polarization as a geophysical measurement refers to the blocking action or polarization of metallic or electronic conductors in a medium of ionic solution conduction.

This electro-chemical phenomenon occurs wherever electrical current is passed through an area which contains metallic minerals such as base metal sulphides. Normally, when current is passed through the ground, as in resistivity measurements, all of the conduction takes place through ions present in the water content of the rock, or soil, i.e. by ionic conduction. This is because almost all minerals have a much higher specific resistivity than ground water. The group of minerals commonly described as "metallic", however, have specific resistivities much lower than ground waters. The induced polarization effect takes place at those interfaces where the mode of conduction changes from ionic in the solutions filling the interstices of the rock to electronic in the metallic minerals present in the rock.

The blocking action or induced polarization mentioned above, which depends upon the chemical energies necessary to allow the ions to give up or receive electrons from the metallic surface, increases with the time that a d.c. current is allowed to flow through the rock; i.e. as ions pile up against the metallic interface the resistance to current flow increases. Eventually, there is enough polarization in the form of excess ions at the interfaces to effectively stop all current flow through the metallic particle. This polarization takes place at each of the infinite number of solution-metal interfaces in a mineralized rock.

When the d.c. voltage used to create this d.c. current flow is cut off, the Coulomb forces between the charged ions forming the polarization cause them to return to their normal position. This movement of charge creates a small current flow which can be measured on the surface of the ground as a decaying potential difference.

From an alternate viewpoint it can be seen that if the direction of the current through the system is reversed repeatedly before the polarization occurs, the effective resistivity of the system as a whole will change as the frequency of the switching is changed. This is a consequence of the fact that the amount of current flowing through each metallic interface depends upon the length of time that current has been passing through it in one direction.

The values of the "metal factor" or "M.F." are a measure of the amount of polarization present in the rock mass being surveyed. This parameter has been found to be very successful in mapping areas of sulphide mineralization, even those in which all other geophysical methods have been unsuccessful. The induced polarization measurement is more sensitive to sulphide content than other electrical measurements because it is much more dependent upon the sulphide content. As the sulphide content of a rock is increased, the "metal factor" of the rock increases much more rapidly than the resistivity decreases.

Because of this increased sensitivity, it is possible to locate and outline zones of less than 10% sulphides that can't be located by E. M. Methods. The method has been successful in locating the disseminated "porphyry copper" type mineralization in the Southwestern United States.

Measurements and experiments also indicate that it should be possible to locate most massive sulphide bodies at a greater depth with induced polarization than with E. M.

Since there is no I. P. effect from any conductor unless it is metallic, the method is useful in checking E. M. anomalies that are suspected of being due to water filled shear zones or other ionic conductors. There is also no effect from conductive overburden, which frequently confuses E. M. results. It would appear from scale model experiments and calculations that the apparent metal factors measured over a mineralized zone are larger if the material overlying the zone is of low resistivity.

Apropos of this, it should be stated that the induced polarization measurements indicate the total amount of metallic constituents in the rock. Thus all of the metallic minerals in the rock, such as pyrite, as well as the ore minerals chalcopyrite, chalcocite, galena, etc. are responsible for the induced polarization effect. Some oxides such as magnetite, pyrolusite, chromite, and some forms of hematite also conduct by electrons and are metallic. All of the metallic minerals in the rock will contribute to the induced polarization effect measured on the surface.

In the field procedure, measurements on the surface are made in a way that allows the effects of lateral changes in the properties of the ground to be separated from the effects of vertical changes in the properties. Current is applied to the ground at two points a distance (X) apart. The potentials are measured at two other points (X) feet apart, in line with the current electrodes. The distance between the nearest current and potential electrodes is an integer number (N) times the basic distance (X).

The measurements are made along a surveyed line, with a constant distance (NX) between the nearest current and potential electrodes. In most surveys, several traverses are made with various values of (N); i.e. (N) = 1, 2, 3, 4, etc. The kind of survey required (detailed or reconnaissance) decides the number of values of (N) used.

In plotting the results, the values of the apparent resistivity and the apparent metal factor measured for each set of electrode positions are plotted at the intersection of grid lines, one from the center point of the current electrodes and the other from the center point of the potential electrodes. The resistivity values are plotted above the line and the metal factor values below. The lateral displacement of a given value is determined by the location along the survey line of the center point between the current and potential electrodes. The distance of the value from the line is determined by the distance (NX) between the current and potential electrodes when the measurement was made.

The separation between sender and receiver electrodes is only one factor which determines the depth to which the ground is being sampled in any particular measurement. These plots then, when contoured, are not section maps of the electrical properties of the ground under the survey line. The interpretation of the results from any given survey must be carried out using the combined experience gained from field, model and theoretical investigations. The position of the electrodes when anomalous values are measured must be used in the interpretation.

In the field procedure, the interval over which the potential differences are measured is the same as the interval over which the electrodes are moved after a series of potential readings has been made. One of the advantages of the induced polarization method is that the same equipment can be used for both detailed and reconnaissance surveys merely by changing the distance (X) over which the electrodes are moved each time. In the past, intervals have been used ranging from 100 feet to 1000 feet for (X). In each case, the decision as to the distance (X) and the values of (N) is largely determined by the expected size of the mineral deposit being sought, the size of the expected anomaly and the speed with which it is desired to progress.

The diagram in Figure 1 below demonstrates the method used in plotting the results. Each value of the apparent resistivity and the apparent "Metal factor" is plotted and identified by the position of the four electrodes when the measurement was made. It can be seen that the values measured for the larger values of (n) are plotted farther from the line indicating that the thickness of the layer of the earth that is being tested is greater than for the smaller values of (n); i.e. the depth of the measurement is increased.

METHOD USED IN PLOTTING DIPOLE-DIPOLE
INDUCED POLARIZATION AND RESISTIVITY RESULTS

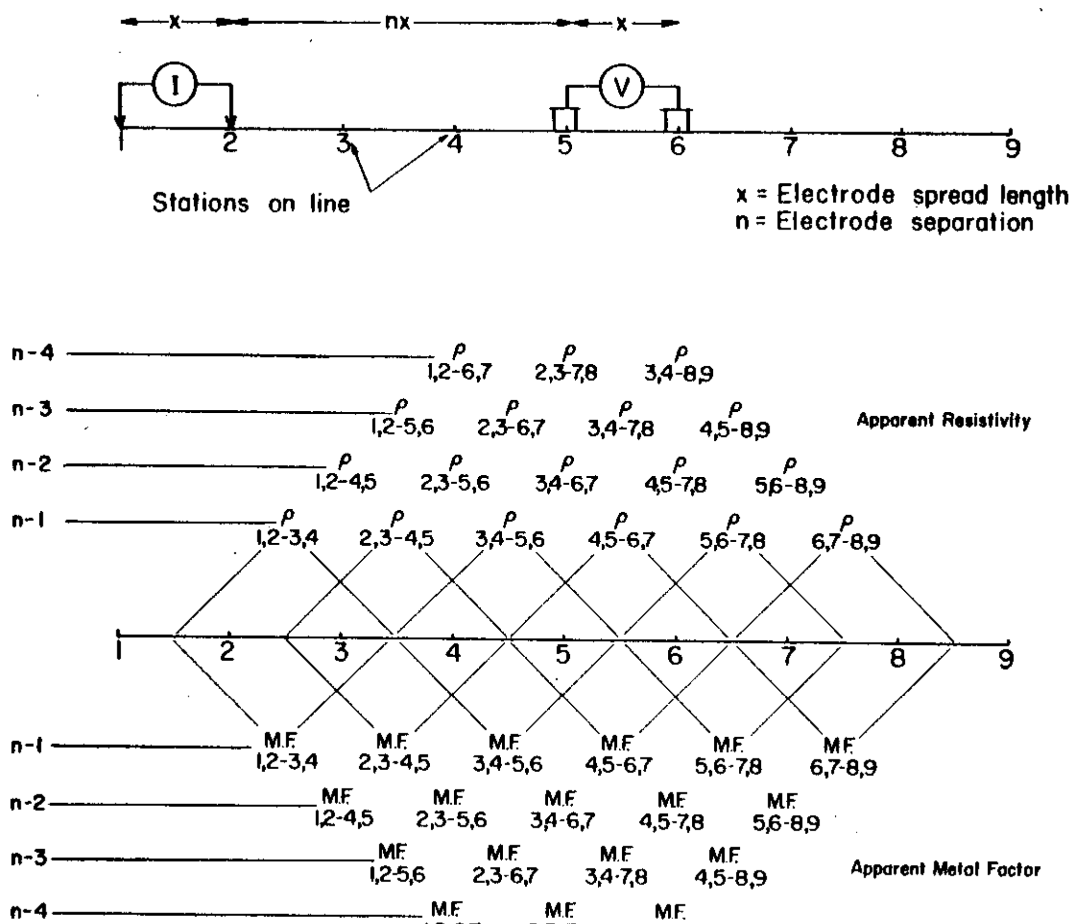

FIG. 1

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REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE J. W. CLAIM GROUP JACK WILSON CREEK AREA FOR KENNCO EXPLORATIONS (WESTERN) LTD.

1. INTRODUCTION

At the request of Mr. H. W. Fleming, geophysicist for the Company, an induced polarization and resistivity survey has been carried out on the J. W. Claim Group in the Jack Wilson Creek Area of British Columbia for Kennco Explorations (Western) Ltd. The property is in the Liard Mining Division, in the southwest quadrant of the 1° quadrilateral whose southeast corner is at 57°N-131°W.

Jack Wilson Creek flows through the center of the area of interest, and a geochemical anomaly for copper has previously been located in the area. In addition, an outcrop containing copper mineralization has been found at approximately 125N on the base line. The induced polarization survey was planned to determine, if possible, the extent of the mineralized zone seen in the outcrop, and to locate any other zones of similar mineralization that might be present.

2. PRESENTATION OF RESULTS

The induced polarization and resistivity results are shown on the following enclosed data plots. The results are plotted in the manner described in the notes preceding this report.

Base line	200' electrode intervals	Dwg. IP 2234-1
Line 105N	200' electrode intervals	Dwg. IP 2234-2
Line 110N	200' electrode intervals	Dwg. IP 2234-3
Line 130N	200' electrode intervals	Dwg. IP 2234-4
Line 138N	200' electrode intervals	Dwg. IP 2234-5
Line 146N	200' electrode intervals	Dwg. IP 2234-6

Also enclosed with this report is Dwg. Misc. 2233, a plan map of the grid on the J. W. Claim Group. The definite and possible induced polarization anomalies are indicated by solid and broken bars respectively on this plan map as well as the data plots. These bars represent the surface projection of the anomalous zones as interpreted from the location of the transmitter and receiver electrodes when the anomalous values were measured.

Since the induced polarization measurement is essentially an averaging process, as are all potential methods, it is frequently difficult to exactly pinpoint the source of an anomaly. Certainly, no anomaly can be located with more accuracy than the spread length; i. e. when using 200' spreads the position of a narrow sulphide body can only be determined to lie between two stations 200' apart. In order to locate sources at some depth, larger spreads must be used, with a corresponding increase in the uncertainties of location. Therefore, while the center of the indicated anomaly probably corresponds fairly well with source, the length of the indicated anomaly along the line should not be taken to represent the exact edges of the anomalous material.

3. DISCUSSION OF RESULTS

The topography in the area of interest has determined, to a certain extent, the position of the lines used for the survey.

Line 100E

This line was surveyed along the stream valley, in a position to cross the known copper mineralization. The results show a moderate magnitude anomaly centered at 125N, with weaker IP effects to the north and south. The source appears to be shallow, and the source could be better positioned using shorter electrode intervals.

The anomaly is not large in magnitude, and the pattern does not suggest a large volume of massive mineralization. The effects could certainly be due to a broad zone of disseminated mineralization such as has been found on the Galore Creek Property.

The IP anomaly, even the weak effects, are accompanied by a decrease in resistivity. This increase in porosity could be due to a rock-type change, or more probably, more intense alteration. The lower resistivities appear to extend at depth to the north, and at some future time the line might be surveyed using larger electrode intervals to look deeper to the north.

Line 105N

The results on this cross line show a narrow, weak anomaly at depth, just west of the base line. There is another weak anomaly at depth at the eastern end of the data. The results do not extend far enough to the east to outline the source. Because of the depth indicated to the source, this anomaly could be as important as the shallow effects over the known mineralization.

Line 110N

Only weak IP effects were measured on this line.

Line 130N

The broad, weak IP effects measured at 98E to 100E on this line correlate with those measured on Line 100E. In addition, there appears to be a similar anomaly to the east.

Line 138N

There are no anomalous IP effects on this line.

Line 146N

There are no anomalous IP effects on this line.

4. CONCLUSIONS AND RECOMMENDATIONS

The strongest IP effects measured on the J. W. Claim Group are on Line 100E, correlating with the known copper mineralization. Other, weak anomalies were located to the south, but there is not enough data to exactly locate the sources.

The lines were limited by topography, and it is possible that the zone located at 125N on Line 100E extends east-west; additional measurements would be necessary to outline the source. However, before additional geophysical work is carried out, it would be desirable to determine the extent and copper content, of the mineralization causing the IP anomaly. A drill hole positioned to pass below 125N on Line 100E at a depth of 150 to 200 feet should intersect the source.

If the mineralization is of economic interest, further IP work can be planned to outline the zones.

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof

Philip G. Hallof,
Geophysicist.

Dated: August 18, 1965

ASSESSMENT DETAILS

PROPERTY: J. W. Claim Group		MINING DIVISION: Liard
SPONSOR: Kennco Exploration (Western) Ltd.		PROVINCE: British Columbia
LOCATION: Jack Wilson Creek Area		
TYPE OF SURVEY: Induced Polarization		
OPERATING MAN DAYS:	17.5	DATE STARTED: July 17, 1965
EQUIVALENT 8 HR. MAN DAYS:	22.0	DATE FINISHED: July 24, 1965
CONSULTING MAN DAYS:	1.5	NUMBER OF STATIONS OCCUPIED: 64
DRAUGHTING MAN DAYS:	3.0	NUMBER OF READINGS TAKEN: 398
TOTAL MAN DAYS:	26.5	MILES OF LINE SURVEYED: 2.19

CONSULTANTS:

P. G. Hallof, 5 Minorca Place, Don Mills, Ontario.

FIELD TECHNICIANS:

J. Parker, Box 340, Choiceland, Saskatchewan.
P. Bellehumeur, Box 72, Ramore, Ontario.
3 helpers supplied by client.

DRAUGHTSMEN:

F. R. Peer, 38 Torrens Avenue, Toronto 6, Ontario.
R. Woods, Apt. 401, 1222 York Mills Road, Don Mills, Ontario.

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof (per RAB)

Philip G. Hallof,
Geophysicist.

Dated: August 18, 1965

SUMMARY OF COST

J. W. Claim Group

Crew

3-1/2 days Operating	@ $185.00/day	$ 647.50
1-1/2 days Standby	@ $ 65.00/day	97.50
3 days Travel	@ $ 65.00/day	195.00
		$ 940.00

Expenses

Airfare	$192.00	
Taxis, etc.	10.00	
Meals and Accommodation	103.41	
Telephone and Telegraph	21.00	
Freight	15.98	
Supplies	23.19	
Miscellaneous	2.25	183.91
	$367.83 x 1/2	$ ~~367.83~~
		~~$1,307.83~~
		1,123.91

McPHAR GEOPHYSICS LIMITED

Philip G. Hallof (per RAB)

Philip G. Hallof,
Geophysicist.

Dated: August 18, 1965

CERTIFICATE

I, Philip George Hallof, of the City of Toronto, Province of Ontario, do hereby certify that:

1. I am a geophysicist residing at 5 Minorca Place, Don Mills, Toronto, Ontario.

2. I am a graduate of the Massachusetts Institute of Technology with a B. S. Degree (1952) in Geology and Geophysics, and a Ph. D. Degree (1957) in Geophysics.

3. I am a member of the Society of Exploration Geophysicists and the European Association of the Exploration Geophysicists.

4. I have been practising my profession for ten years.

5. I have no direct or indirect interest, nor do I expect to receive any interest, direct or indirect, in the property or securities of Kennco Explorations (Western) Limited.

6. The statements made in this report are based on a study of published literature and unpublished private reports and geophysical data.

Dated at Toronto

This 18th day of August 1965.

Philip G. Hallof (per ...)

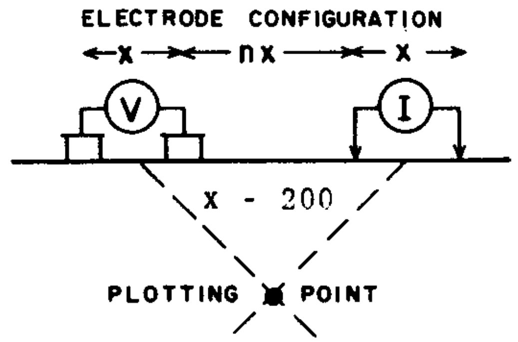
Philip G. Hallof, Ph. D.

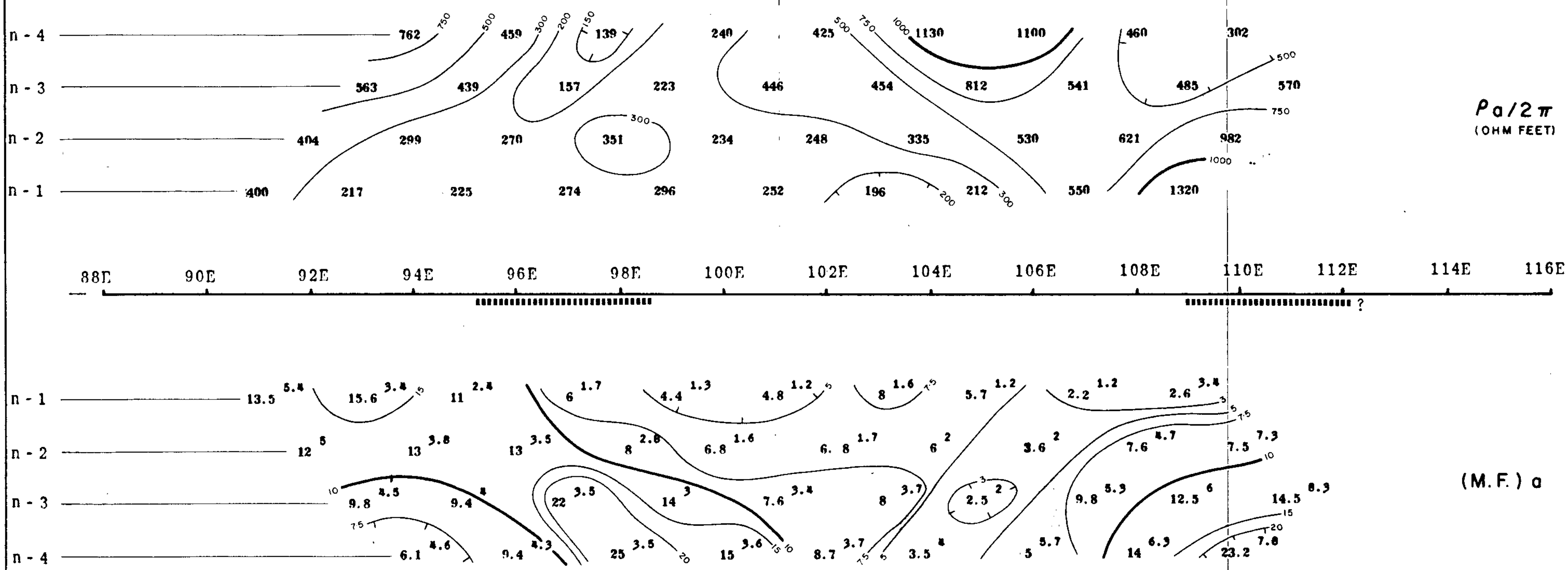
DWG. NO.-I.P.-2234-2

McPHAR GEOPHYSICS LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 669 MAP 2





LINE NO.- 105 N

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

KENNCO EXPLORATIONS (WESTERN) LIMITED

J.W. CLAIM GROUP, JACK WILSON CREEK AREA, LIARD M.D.—B.C.

Scale—One inch = 200 Feet

NOTE LOGARITHMIC CONTOUR INTERVAL

669

McPHAR GEOPHYSICS LIMITED

FREQUENCY 0.31-5 CPS

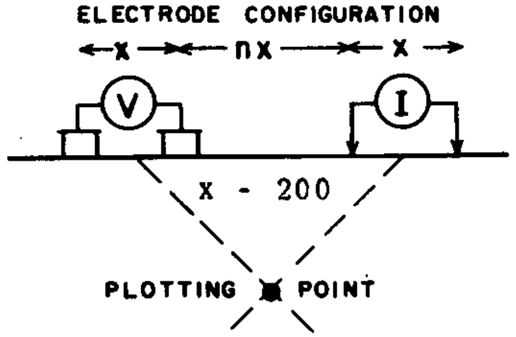
DATE SURVEYED JULY, 1965

APPROVED

DATE 8/16/65

DWG. NO.–I.P.–2234–3

ELECTRODE CONFIGURATION



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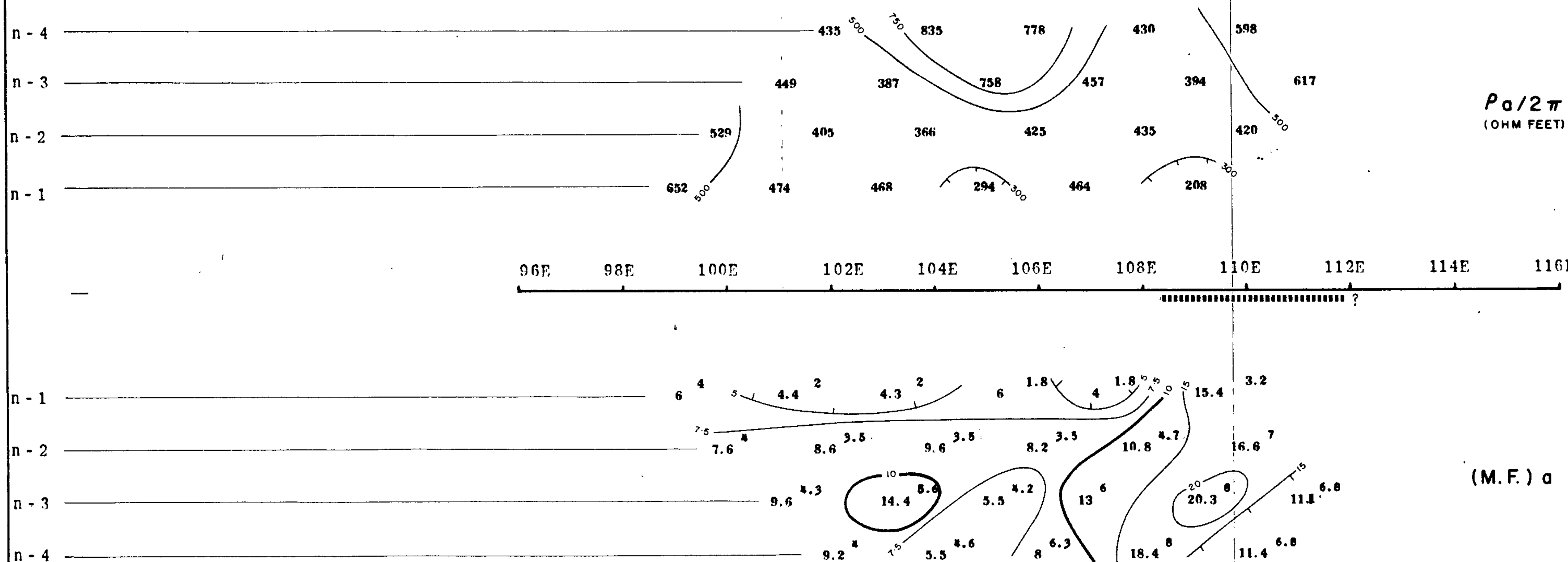
INDUCED POLARIZATION AND RESISTIVITY SURVEY



LINE NO.–110 N

KENNCO EXPLORATIONS (WESTERN) LIMITED

J.W. CLAIM GROUP, JACK WILSON CREEK AREA, LIARD M.D.—B.C.

Scale—One inch = 200 Feet

NOTE: LOGARITHMIC CONTOUR INTERVAL

669

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

FREQUENCY 0.31–5 CPS

DATE SURVEYED JULY 1965

APPROVED

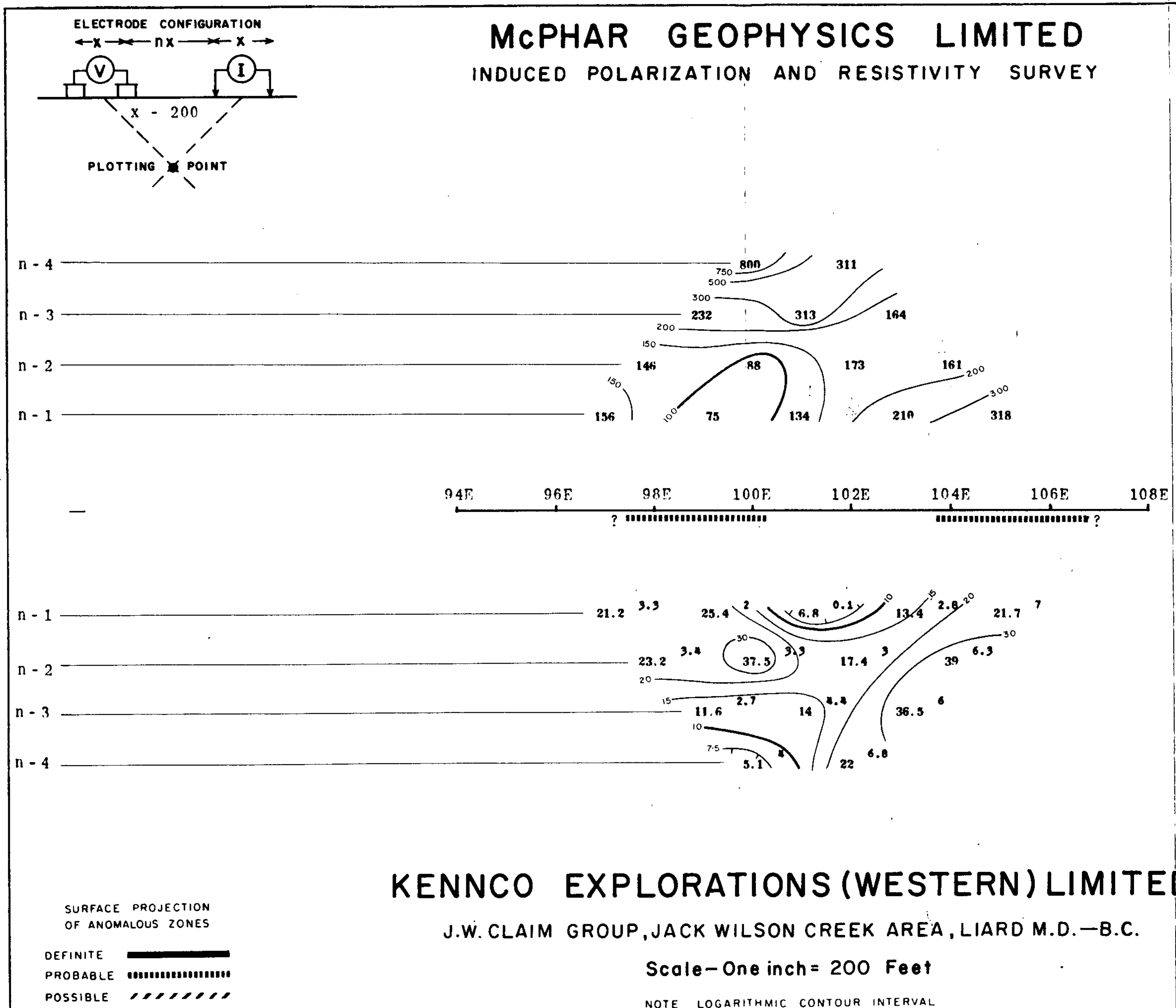
DATE 8/16/65

DWG. NO.-I.P.-2234-4

McPHAR GEOPHYSICS LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 669 MAP 4



KENNCO EXPLORATIONS (WESTERN) LIMITED

J.W. CLAIM GROUP, JACK WILSON CREEK AREA, LIARD M.D.—B.C.

Scale—One inch = 200 Feet

NOTE LOGARITHMIC CONTOUR INTERVAL

669

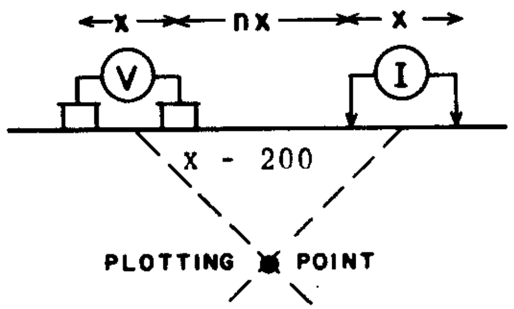
FREQUENCY 0.31 - 5 CPS
DATE SURVEYED JULY 1965
APPROVED
DATE 8/16/65

DWG. NO.-I.P.-2234-5

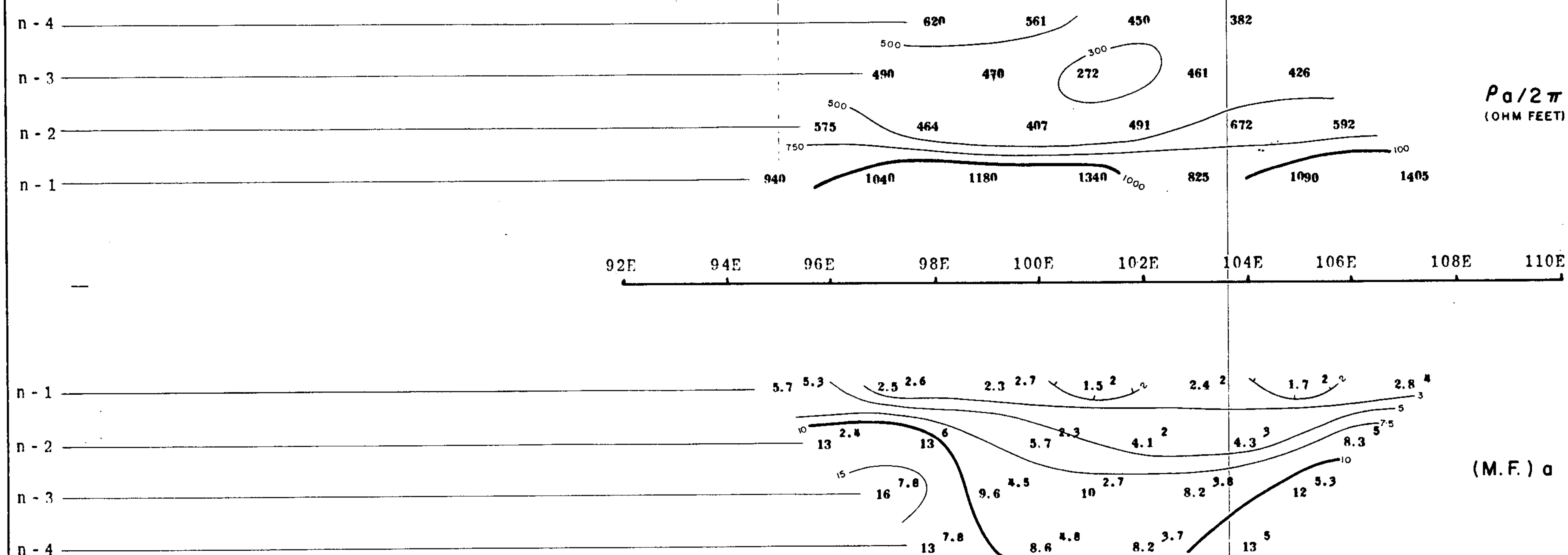
McPHAR GEOPHYSICS LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

ELECTRODE CONFIGURATION



Department of Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 669 MAP 5



LINE NO.- 138 N

KENNCO EXPLORATIONS (WESTERN) LIMITED

J.W. CLAIM GROUP, JACK WILSON CREEK AREA, LIARD M.D.—B.C.

Scale—One inch = 200' Feet

NOTE LOGARITHMIC CONTOUR INTERVAL

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

669

FREQUENCY 0.31 - 5 CPS

DATE SURVEYED JULY 1965

APPROVED

DATE 8/16/65

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DWG. NO.-I.P.-2234-6

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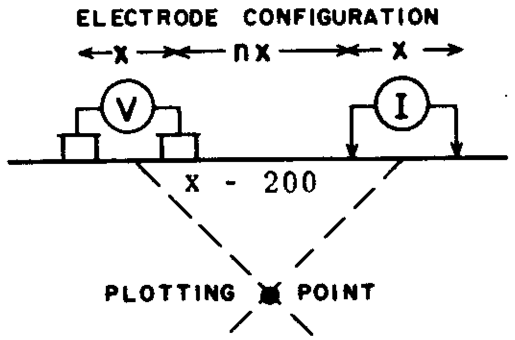
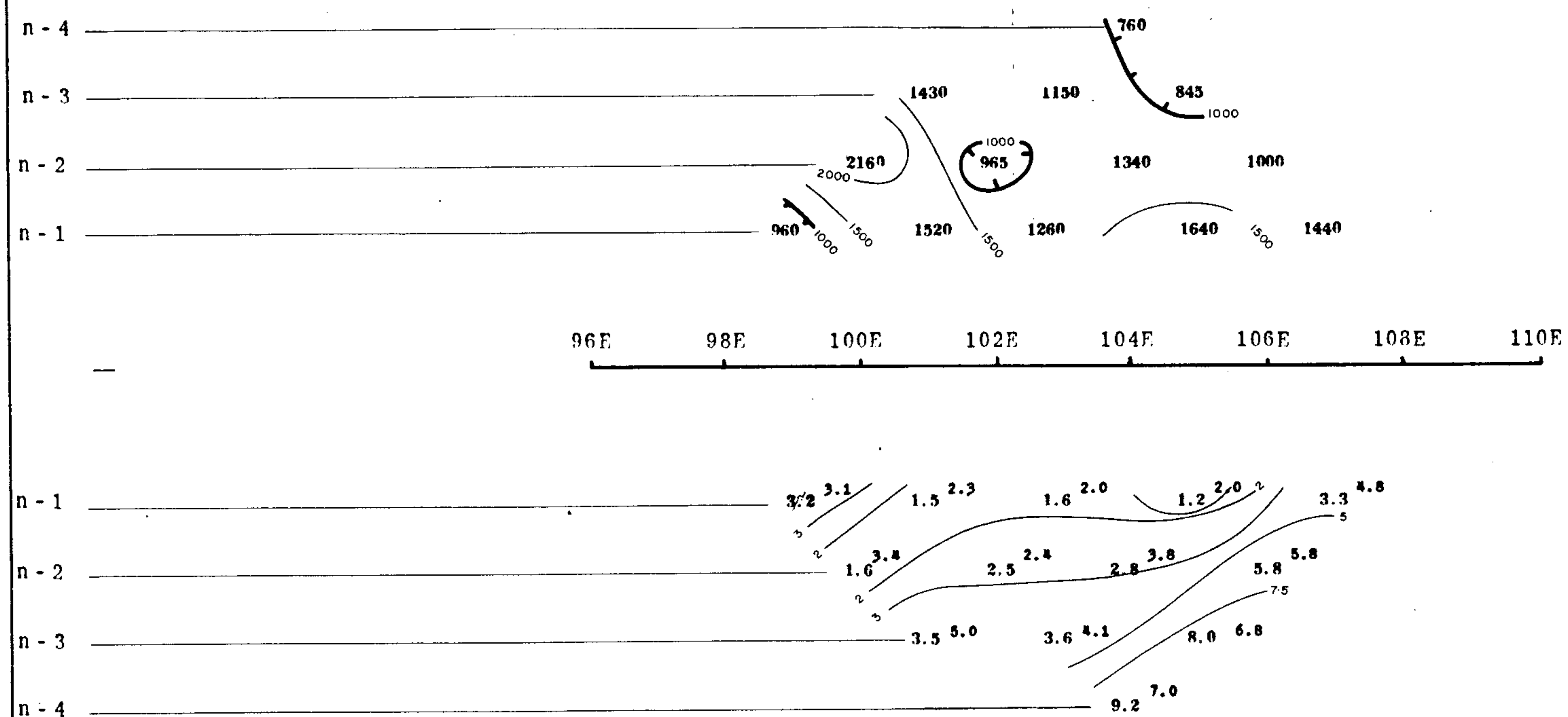
INDUCED POLARIZATION AND RESISTIVITY SURVEY



Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 669 MAP 6



$\rho a/2\pi$
(OHM FEET)

(M.F.) a

LINE NO.- 146 N

KENNCO EXPLORATIONS (WESTERN) LIMITED

J.W. CLAIM GROUP, JACK WILSON CREEK AREA, LIARD M.D.—B.C.

Scale—One inch = 200 Feet

NOTE: LOGARITHMIC CONTOUR INTERVAL

SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE
PROBABLE
POSSIBLE

669

FREQUENCY 0.3 + 5 CPS
DATE SURVEYED JULY 1965
APPROVED
DATE 8/16/65

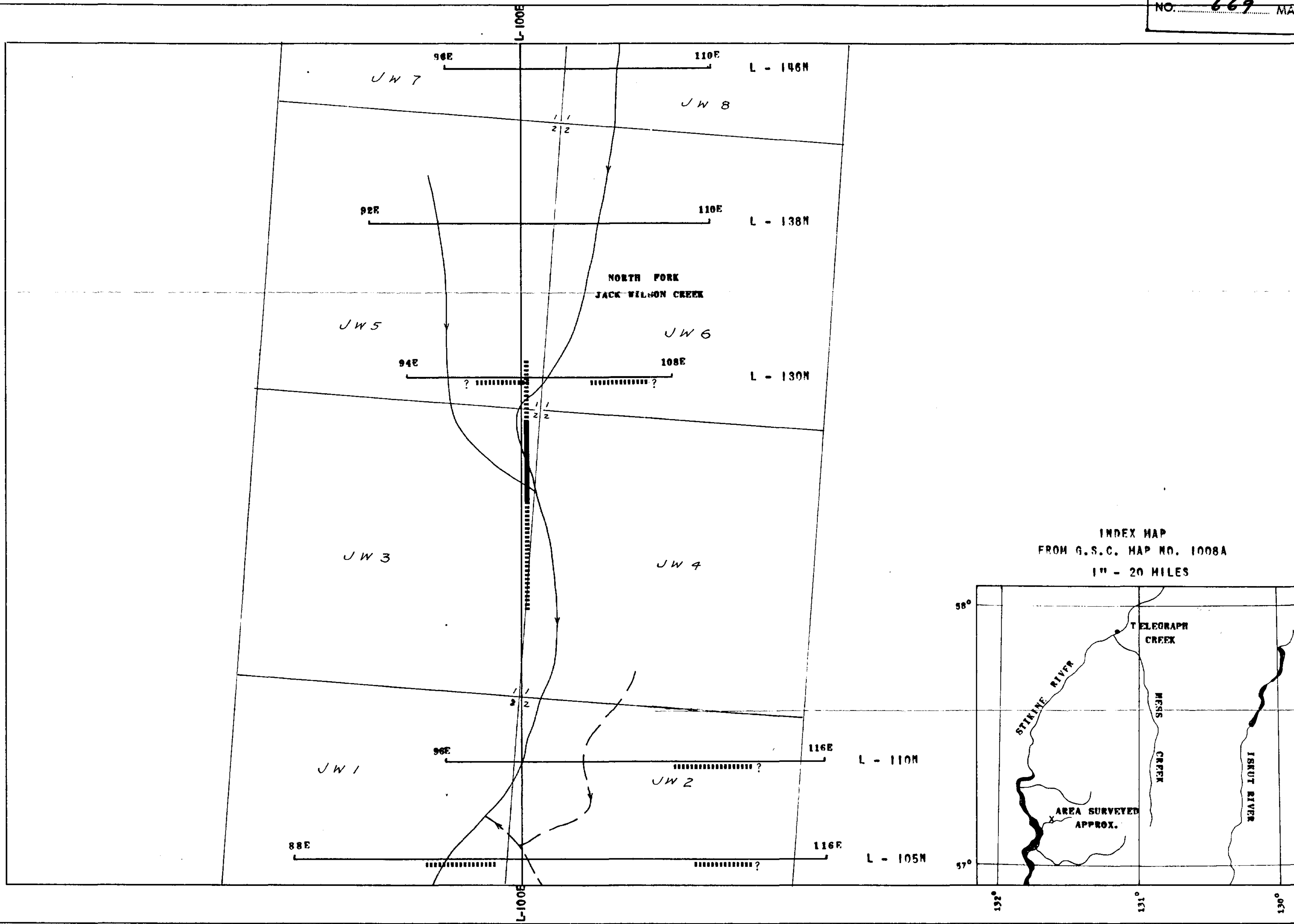
McPHAR

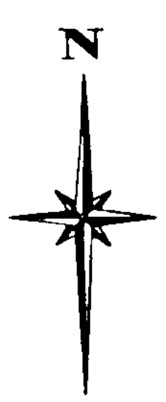

McPHAR GEOPHYSICS LIMITED
INDUCED POLARIZATION AND RESISTIVITY SURVEY
ELECTRODE CONFIGURATION
x - 200
PLOTTING POINT
Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 669 MAP 1
n - 4
n - 3
n - 2
n - 1
Pa/2π
(OHM FEET)
100N
102N
104N
106N
108N
110N
112N
114N
116N
118N
120N
122N
124N
126N
128N
130N
132N
134N
136N
138N
140N
142N
144N
146N
148N
150N
LINE NO.- 100 E
(M.F.) a
SURFACE PROJECTION
OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE
KENNCO EXPLORATIONS (WESTERN) LIMITED
J.W. CLAIM GROUP, JACK WILSON CREEK AREA, LIARD M.D.—B.C.
Scale—One inch= 200 Feet
NOTE LOGARITHMIC CONTOUR INTERVAL
669
M1
FREQUENCY 0.31 - 5 CPS
DATE SURVEYED JULY 1965
APPROVED PH
DATE 8/16/65

McPHAR GEOPHYSICS LIMITED

INDUCED POLARIZATION AND RESISTIVITY SURVEY

LOCATION MAP





SURFACE PROJECTION OF ANOMALOUS ZONES

DEFINITE

PROBABLE

POSSIBLE

KENNCO EXPLORATIONS (WESTERN) LIMITED

J.W. CLAIM GROUP, JACK WILSON CREEK AREA, LIARD M.D.—B.C.

SCALE

One Inch =Four Hundred Feet

DRAWN: F.R.P.
DATE: AUGUST, 1965
APPROVED: P.H.
DATE: 8/16/65

M2