81-#863 #9643

REPORT ON THE INDUCED POLARIZATION AND RESISTIVITY SURVEY ON THE SKEETER GROUP OF MINERAL CLAIMS LIARD MINING DIVISION, B.C.

FOR
TECK CORPORATION
BY

A. I. BETMANIS, P.Eng.

Claims:	P 29-42, 49, 50
Record Nos:	71339-52, 71359, 71360
Location:	57°27½'N, 130°57½'W.
NTS:	104 G/7W
Owner:	Teck Corporation
Operator:	Teck Explorations Ltd.
Contractor:	Phoenix Geophysics Ltd.

9643

Vancouver, B. C. October 22, 1981

TABLE OF CONTENTS

INTRODUCTION

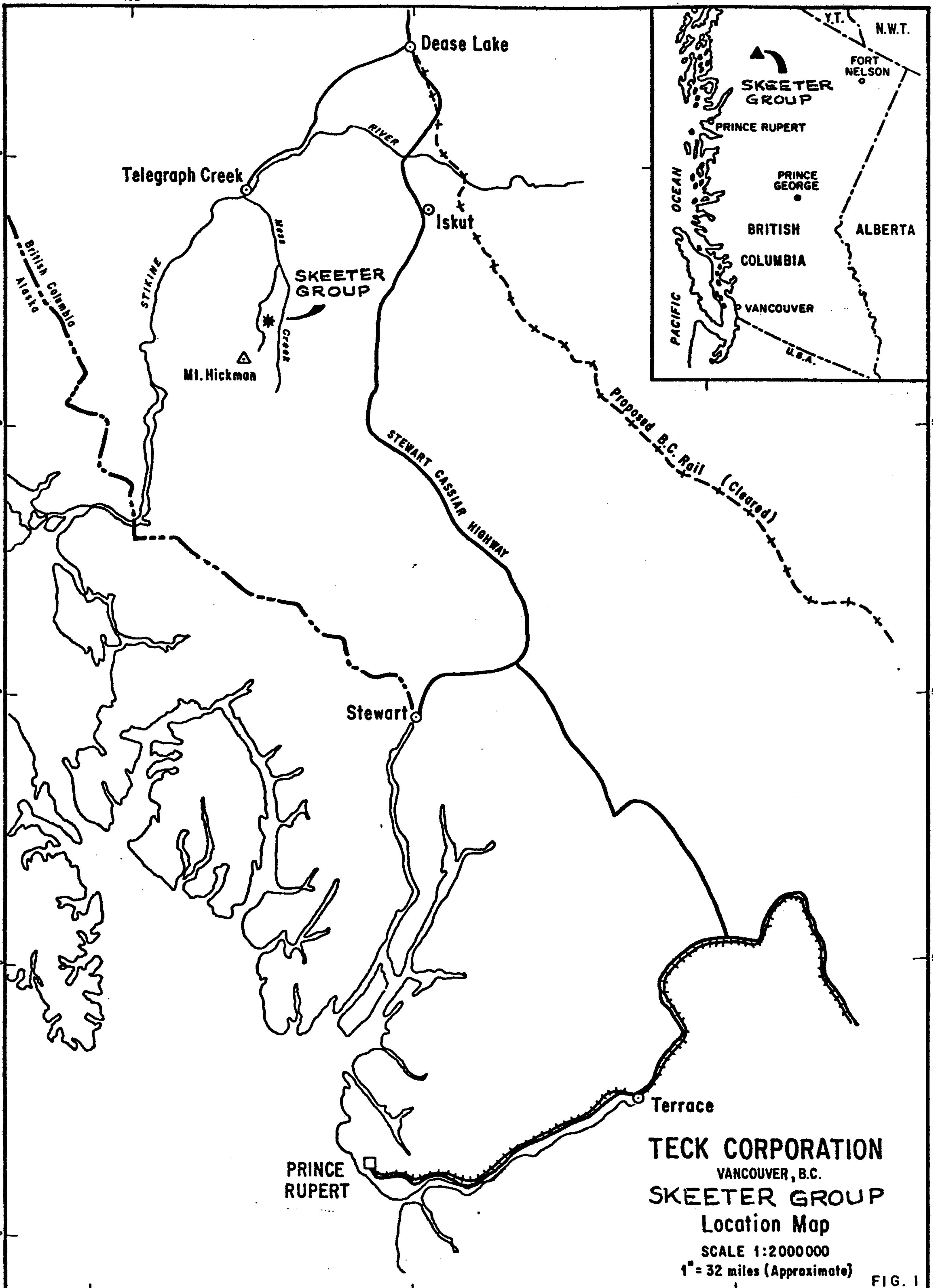
Teck Corporation are exploring the Schaft Creek porphyry copper-molybdenum deposit of Liard Copper Mines Ltd. in northwestern British Columbia. The Skeeter Lake valley located between Schaft and Mess Creeks, has been selected as the most likely location for tailings disposal from the deposit.

As part of the 1981 exploration program, it was decided to test the tailings pond area with diamond drilling to verify absence of economic mineralization. During 1973, Hecla Operating Company, operators of the property at that time, had contracted McPhar Geophysics Ltd. to survey four induced polarization reconnaissance lines in the tailings pond area. The results indicated possible anomalies, but the lines were too widely spaced to provide useful drilling targets.

Phoenix Geophysics Ltd. were contracted by Teck Explorations Ltd. in 1981 to survey additional lines using the dipole-dipole induced polarization method.

(a) Location and Access

The Skeeter Group of claims are located in a northerly draining valley between Schaft and Mess Creeks, approximately 55 km S10^{O}E from Telegraph Creek and



TECK CORPORATION
VANCOUVER, B.C.

SKEETER GROUP
Location Map
SCALE 1:2000000
1" = 32 miles (Approximate)

FIG. 1

75 km S55°W from Iskut, in the Liard Mining Division, B.C. Geographical co-ordinates of the centre of the geophysical grid are 57°27½'N, 130°57½'W (NTS 104 G/7W). Elevations vary from approximately 820 to 780 metres a.s.l.

Access to the property is by approximately 15 km of rough dirt road from the Schaft Creek gravel airstrip located in Schaft Creek Valley by Hickman Creek. Alternately, float planes may land at Skeeter Lake located centrally in the claim group. For the purposes of this survey a helicopter based at Schaft Creek was used to transport crews daily from the Schaft Creek camp to the survey area.

(b) Property and Ownership

The Skeeter Group of mineral claims consists of 100 contiguous 2-post claims and units of metric claims as listed in Appendix IV. The 2-post claims are held in the name of Teck Corporation under option agreement with Liard Copper Mines Ltd. and Hecla Operating Company. The metric system claims (Swamp, Side Hill and Hill) were staked for Teck Corporation.

(c) Claims Surveyed

The claims over which induced polarization surveying was done by Phoenix Geophysics Ltd. from July 29 to August 4, 1981 are P 29 to 42 (record numbers 71339 to 71352), P 49 (record number 71359), and P 50 (record number 71360).

Surveying of additional lines on other claims was completed at a later date, and has not been claimed for assessment credits

(d) <u>Previous Work on Claim Group</u>

During 1971 Hecla Operating Company performed a soil geochemical survey for copper, a ground magnetometer survey, and geological mapping of the Skeeter Lake valley using a cut and picketed grid with 500 foot line spacings (House, 1971). A few minor chalcopyrite showings were located and several small weakly anomalous soil areas outlined. The magnetometer survey helped correlation of geology.

In 1973 Hecla contracted McPhar Geophysics Ltd. to survey four induced polarization lines in the area using the dipole-dipole method and 200 foot electrode separations with electrode spread lengths of 1 to 4 times electrode separation (Hallof and Goudie, 1973). Possible and probable anomalies were obtained on all four lines, but the lines were too widely spaced (6,000; 3,000; and 5,000 feet) to correlate anomalous trends. Three shallow test holes to 150 feet were recommended on one of the lines, but were not drilled by Hecla.

(e) General Geology

The survey area is underlain almost entirely by Upper Triassic pyroclastic and volcaniclastic andesitic rocks and augite-andesite sub-volcanic intrusions. The volcanics have been intruded by a few widely spaced small dioritic to quartz monzonite bodies. Geological mapping in 1971 indicates north-northeast strikes with moderate westerly dips of the volcanics in the southern part of the area, and a possible northeasterly plunging anticline in the central area. Structural data in the northern part are too sparce for interpretation

Immediately to the southeast of the survey area tightly folded north-northeast striking Upper Triassic and pre-volcanic quartzites and limestones outcrop. These apparently have not been intruded by the intermediate intrusives. They seem to be in fault contact with the volcanics to the north, and either a fault contact or an unconformity with the volcanics to the west.

The augite-andesite sub-volcanics are usually well mineralized with magnetite, which is presumed to be primary. Pyrite and minor to trace amounts of chalcopyrite occur in the vicinity of the intermediate intrusives.

SURVEY DATA AND PRESENTATION OF RESULTS

Standard dipole-dipole induced polarization transmitters and receivers manufactured by Phoenix Geophysics Ltd. were used for the survey. Iron pins were used for electrodes with the assistance of saline solution for contacts as required. Electrode separations of 300 feet were used for transmitter and receiver, and readings were taken at electrode spread lengths of 1, 2 and 3 times the electrode separation. Apparent resistivities, apparent frequency effects, and apparent metal factors were plotted on pseudo-sections as common to standard procedures of dipole-dipole induced polarization surveys. Plots of pseudo-sections are shown in Appendix I. Pertinent notes on the dipole-dipole method are attached as Appendix V.

The survey was carried out on the original 1,000 foot spaced line grid used by Hecla Operating Company in 1971. Grid lines were re-established, re-cut and chained using the same co-ordinates as used for the four reconnaissance induced polarization lines surveyed in 1973. Although the final survey covered a larger area, a total of 12 line-miles of induced polarization surveying was claimed for assessment credits and is covered by this report.

The pseudo-sections were filtered for contour map presentation as described in Appendix VI. The filtered frequency effects and metal factors are shown in contoured plan on Map 2, as well as the station values on the pseudo-sections.

DISCUSSION OF RESULTS

Resistivities are variable in the surveyed area, and range from less than 50 to over 5,000 $\rho/2\pi$ ohm-feet. A number of these extreme variations are presumed to be due to structure and/or lithological horizons. The resistivity variations strongly affect the metal factors, and therefore considerable emphasis should be given to apparent frequency effects when interpreting anomalous zones.

The contour map of filtered frequency effects and metal factors reveals anomalous trends better than direct interpretation of pseudo-sections. The filtered results made it apparent that the survey should be extended to both north and south prior to drill testing. This was done soon after completion of the initial survey, but the results are outside the scope of this report. However, the contoured filter values of the extended survey are shown on Map 2.

Examination of induced polarization surveys from the Liard Copper deposit to the southwest indicates that drill testing of the main anomalous zones may not be the best way of locating economic mineralization due to pyritic halos and magnetite rich sub-volcanics. Recommendations based on this survey therefore take into account experience from the Liard Copper deposit.

(a) Anomaly on Line 5S

A strong metal factor anomaly occurs between 11 and 17W and another with depth between 2 and 7W. The first anomaly is probably due to very low resistivities, and is not supported by frequency effects. The anomaly between 2 and 7W is enforced by frequency effects and may be due to mineralization. It is also in an area where chalcopyrite occurrences have been found in outcrop. The anomaly is open to the south.

(b) Anomalies on Lines 45N to 55N

Frequency effects on lines 45N and 55N are relatively high with majority of readings on both lines being in the possibly anomalous range. Metal factor anomalies occur between 3E and 10E on line 45N and between 2E and 6E on line 55N. The former metal factor anomaly is relatively shallow, but is not as strong as the deeper anomaly on line 55N. Line 50N surveyed by McPhar in 1973, supports the anomalous readings but indicates that the anomalies on lines 45N and 55N may not correlate directly. The anomalies, if tested, should be treated individually.

(c) Anomaly on Line 75N

Strong metal factor and frequency effect readings were obtained on line 75N between approximately 6E and 14E, and represent the most positive anomaly from the survey. Geological mapping indicates that the area is underlain by sedimentary tuff, and no sulphides were observed in outcrop. The magnetometer survey does not indicate any anomalous accumulation of magnetite. The induced polarization anomaly therefore is unexplained by any known additional data. The 1973 McPhar survey of line 80N indicates that the anomaly may be reduced in magnitude to the north, but additional surveying would be required to outline the anomaly sufficiently.

CONCLUSIONS AND RECOMMENDATIONS

Several induced polarization anomalies were obtained from the survey. However, the strongest anomalies from metal factor and frequency effect were obtained at the north and south limits of the survey, and therefore the survey should be extended in both directions prior to drill testing.

Unless extensions of the survey indicate otherwise, drill testing of anomalies is recommended at L5S, 2+25W; L45S, 6+50E; L55N, 2+50E; and L75N, 11+50E. In case of anomalies from lines 45N to 75N being due to a pyritic halo surrounding economic mineralization, a drill hole at approximately 8E on line 65N is recommended also.

Complete testing of the anomalies would require drill hole depths of at least 800 or 1000 feet to achieve maximum depth of the survey penetration. However, 400 foot holes may be sufficient if non-economic mineralization explaining the anomalous response is encountered.

Respectfully submitted,

A. I. Betmanis, P.Eng.

AIB:mjb

October 22, 1981
Vancouver, B. C.

REFERENCES

House, G.D. (1971): Geological, Geochemical, and Magnetic Surveys of the BB #31, MV #5, and MV #11 Claim Groups, Schaft Creek Area, B. C. for Hecla Operating Company; dated December 29, 1971; (submitted for assessment.

Hallof, P.G., and Goudie, M.A. (1973): Report on the Induced Polarization and Resistivity Survey on the Schaft Creek Property, Liard Mining Division, B. C., for Hecla Operating Company; dated November 23, 1973 (submitted for assessment).

Linder, H. (1975): Geology of the Schaft Creek Porphyry Copper and Molybdenum Deposit, Northwestern B.C.; CIM Bull. Vol.68, no. 758, pp 49-63.

AUTHOR'S CERTIFICATE

I, Andris I. Betmanis, do hereby certify that:

I am a geologist residing at 1988 Arroyo Court, North Vancouver, B. C., and am employed by Teck Explorations Ltd.;

I am a graduate of the University of Toronto with a B.A.Sc. degree in Applied Geology;

I am a registered member of the Association of Professional Engineers of the Province of British Columbia;

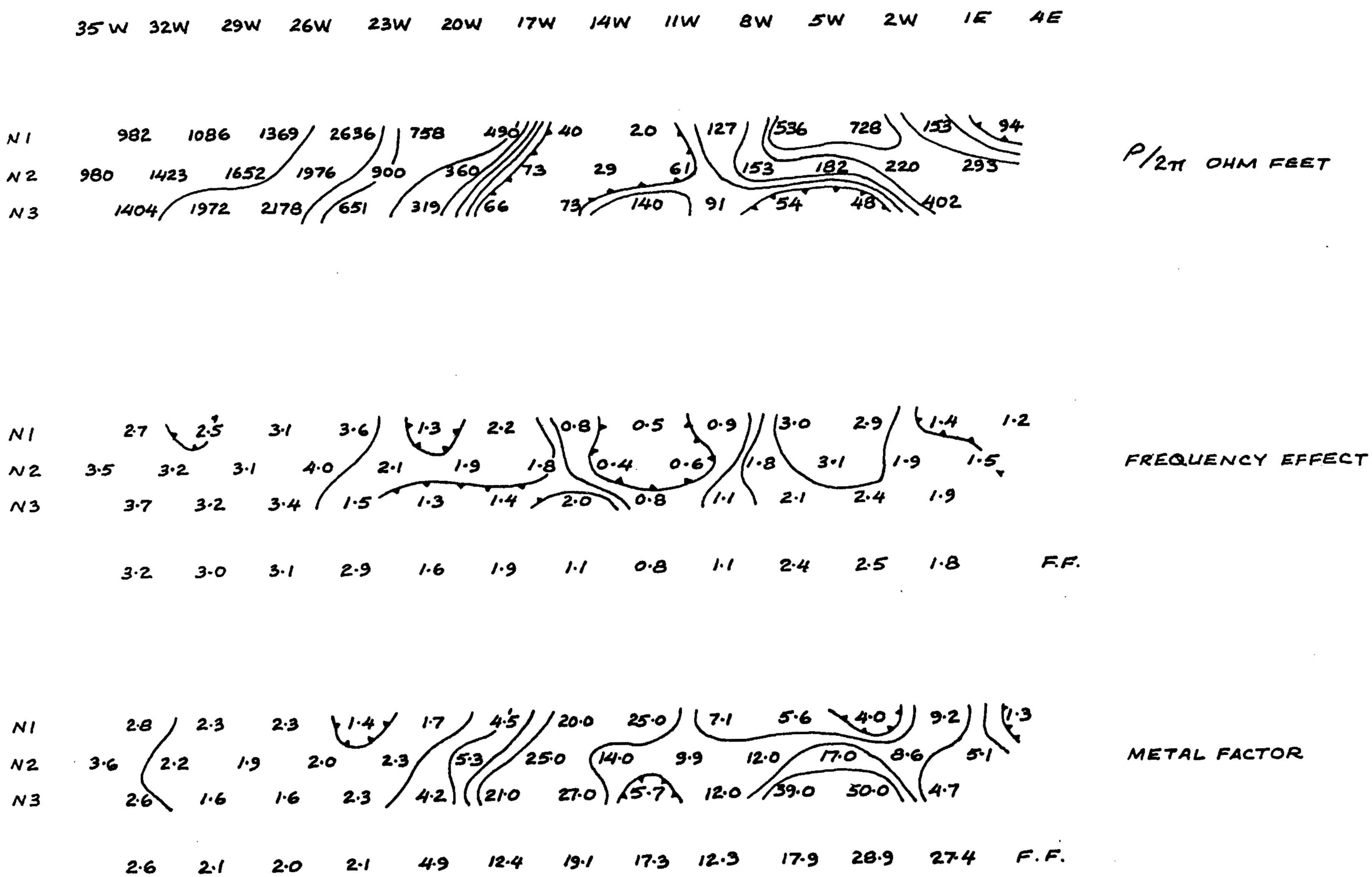
I have practised my profession in geology and mineral exploration continuously since 1965, and since 1970 in British Columbia;

During July and August 1981 I supervised the induced polarization and resistivity surveys contracted to Phoenix Geophysics Ltd. by Teck Explorations Ltd. on the Skeeter Group of claims in the Schaft Creek area.

A. I. Betmanis, P.Eng.

APPENDIX I

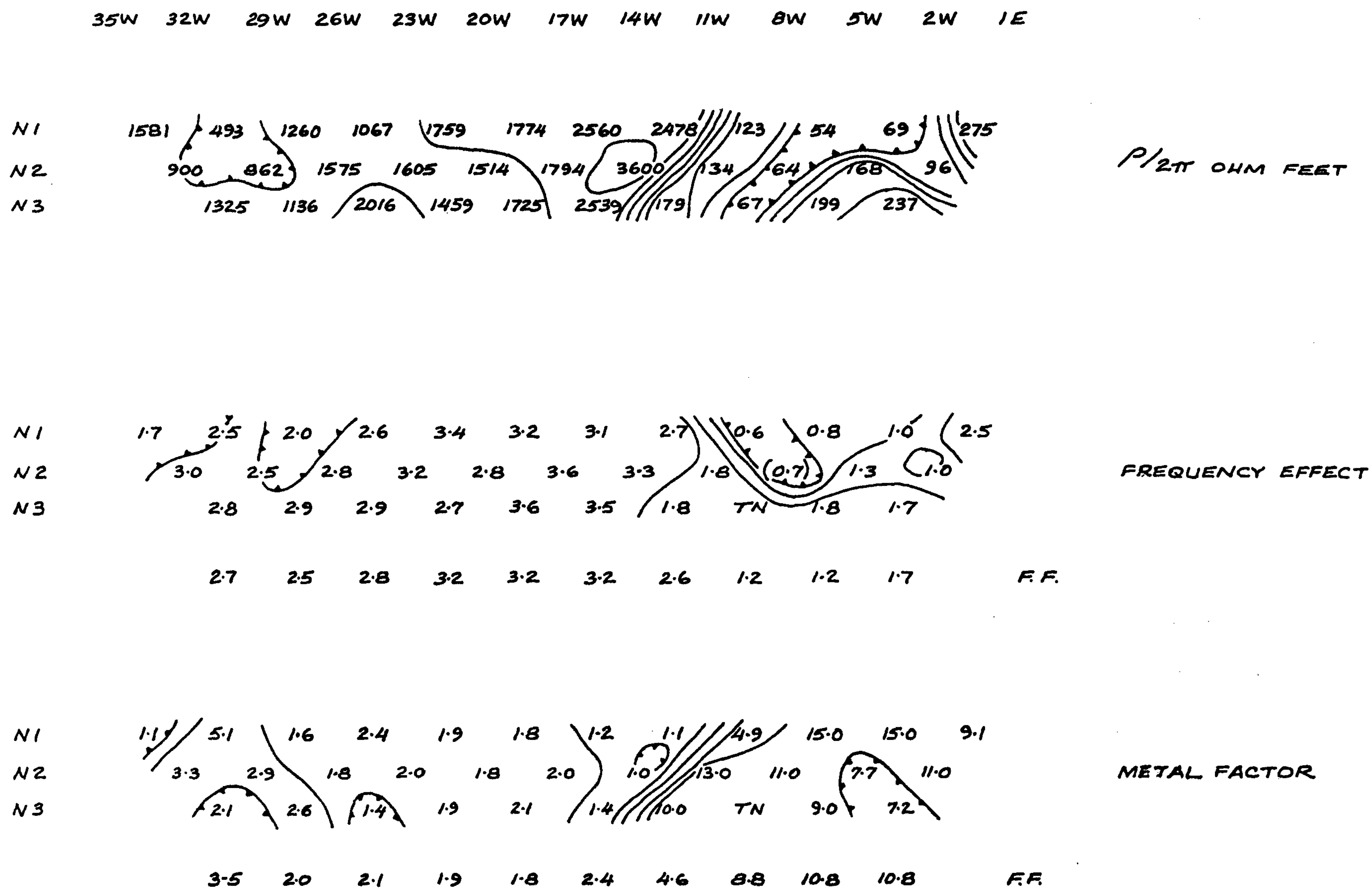
PSEUDO-SECTIONS 5S to 75N



Spread - 300 ft.
Freq. - 44.25 Hz.
Operator - R. Fernholm
Date - July 29, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
N.R. - Too Noisy to Read.

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 5S PSEUDO-SECTION
1 in. = 600 ft.



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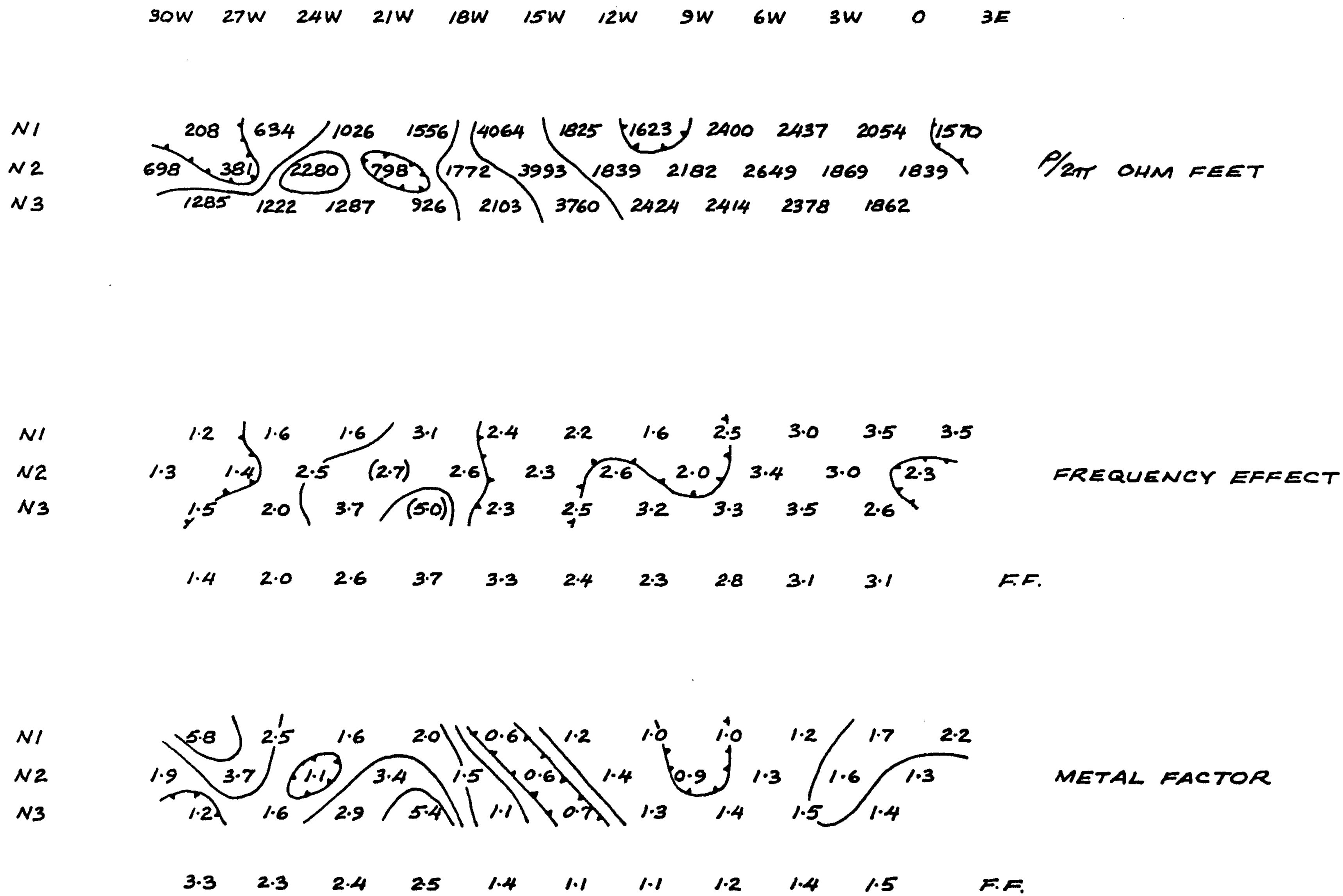
Freq. - 44·25 Hz.
Operator - R. Fernholm
Date - July 30, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 5N PSEUDO-SECTION
1 in. = 600 ft.



Spread - 300 ft.
Freq. - 44·25 Hz.
Operator - R. Fernholm
Date - July 31, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVE
LINE 15N PSEUDO-SECTION
1 in. = 600 ft.

30W 27W 24W 21W 18W 15W 12W 9W 6W 3W 0 3E

ρ/2π OHM-FEET

N1	361	489	821	1689	2365	2664	3305	4599	2276	1481	1468
N2	815	972	929	1008	3371	2581	1868	5072	3074	1729	2079
N3	1938	1516	1075	1710	3078	2192	2917	3813	2610	2013	

FREQUENCY EFFECT

N1	0.6	0.8	1.9	2.3	1.9	2.0	1.5	1.4	2.0	2.3	2.2
N2	2.3	1.2	1.3	1.9	2.2	2.3	1.7	1.8	2.0	2.7	2.6
N3	2.8	1.2	1.6	2.3	2.4	2.4	2.4	2.4	3.0	3.1	
F.F.	1.5	1.3	1.7	2.2	2.2	2.1	1.9	2.0	2.5	2.7	

METAL FACTOR

N1	1.7	1.6	2.3	1.4	0.8	0.8	0.5	0.3	1.0	1.6	1.5
N2	2.8	1.2	1.4	1.9	0.7	0.9	0.9	0.4	0.7	1.6	1.3
N3	1.4	0.8	1.5	1.3	0.8	1.1	0.8	0.6	1.1	1.5	
F.F.	1.6	1.4	1.7	1.3	0.9	0.9	0.7	0.6	1.1	1.5	

Spread - 300 ft.
Freq. - 44.25 Hz.
Operator - R. Farnholm
Date - July 31, Aug. 1, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 25N PSEUDO-SECTION
1 in. = 600 ft.

30W 27W 24W 21W 18W 15W 12W 9W 6W 3W 0 3E 6E

ρ/2π OHM FEET

N1	683	569	654	913	1165	798	1345	3054	1511	1420	920	1207
N2	915	651	1537	1133	664	1145	2678	2351	1505	988	1346	928
N3	839	1671	1972	960	765	3315	3600	1128	891	958	1472	

FREQUENCY EFFECT

N1	1·2	1·0	1·8	2·1	4·2	6·6	5·0	4·2	2·9	2·6	3·4	4·7
N2	1·3	1·0	2·0	3·2	3·9	5·7	4·4	4·6	4·3	4·3	3·8	4·0
N3	1·7	1·9	3·2	4·2	5·1	3·6	4·3	5·0	4·9	4·8	4·8	
F.F.	1·4	1·6	2·5	3·3	4·4	5·3	4·6	4·5	4·0	3·8	4·0	

METAL FACTOR

N1	1·8	1·8	2·8	2·3	3·6	8·3	3·7	1·4	1·9	1·8	3·7	3·9
N2	1·4	1·5	1·3	2·8	5·9	5·0	1·6	2·0	2·9	4·4	2·8	4·3
N3	2·0	1·1	1·6	4·4	6·7	1·1	1·2	4·4	5·5	5·0	3·3	
F.F.	1·6	1·6	2·4	3·6	4·4	4·9	2·6	2·5	3·5	3·3	3·8	

Spread - 300 ft.
Freq. - 44·25 Hz.
Operator - R. Fernholm
Date - Aug. 1, 2, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 35 N PSEUDO-SECTION
1 in. = 600 ft.

13W 10W 7W 4W 1W 2E 5E 8E 11E 14E 17E 20E 23E 26E

P/2π OHM FEET

N1 1451 1334 860 446 587 595 250 338 892 286 1170 769

N2 1279 1636 805 370 739 1146 328 424 1599 288 484 1110 308

N3 1313 868 388 573 1288 641 462 1592 384 536 409 566 293

FREQUENCY EFFECT

N1 3.8 3.1 4.6 6.4 7.5 5.8 9.0 6.6 6.6 4.4 1.1 2.5

N2 4.7 3.4 4.1 7.6 5.2 6.1 8.4 7.2 4.3 5.5 3.9 2.5 5.2

N3 4.0 4.8 5.4 6.6 4.5 8.1 7.1 4.7 3.9 4.8 5.1 4.7 (3.7)

F.F. 4.1 3.9 5.4 6.1 6.5 6.5 7.8 5.9 5.3 4.6 3.1 3.6

METAL FACTOR

N1 2.6 2.3 5.3 14.0 13.0 9.8 36.0 20.0 7.4 15.0 0.9 3.3

N2 3.7 2.1 5.1 21.0 7.0 5.3 26.0 17.0 2.7 19.0 8.1 2.3 17.0

N3 3.0 5.5 14.0 12.0 3.5 13.0 15.0 3.0 10.0 9.0 13.0 8.3 13.0

F.F. 3.3 3.1 9.6 12.6 9.6 12.0 22.6 13.1 8.5 17.6 5.4 8.1

Spread - 300ft
Freq. - 44.25 Hz
Operator - R. Fernholm
Date - Aug 2, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 45N PSEUDO-SECTION
1 in = 600 ft.

Station	11W	8W	5W	2W	1E	4E	7E	10E	13E	16E	19E	22E	25E

ρ/2π OHM FEET

N1	1407	860	586	617	518	456	324	876	1485	1599	2295	722
N2	1961	1088	449	764	762	111	348	285	2314	1832	1242	1532
N3	1178	568	779	921	241	107	296	976	2142	1243	824	

FREQUENCY EFFECT

N1	2.2	2.0	4.8	6.7	7.8	1.1	4.6	8.7	7.8	1.8	2.3	4.0
N2	2.7	3.2	(5.0)	5.5	7.7	4.9	4.7	(3.3)	6.4	7.2	2.4	4.3
N3	3.5	(5.6)	(4.6)	6.4	4.5	7.9	(3.3)	2.5	6.2	7.6	5.0	
F.F.	3.2	3.6	5.2	6.2	6.8	3.7	4.4	5.9	6.7	4.3	4.0	

METAL FACTOR

N1	1.6	2.3	8.2	11.0	15.0	2.4	14.0	9.9	5.3	1.1	1.0	5.5
N2	1.4	2.9	11.0	7.2	10.0	44.0	14.0	12.0	2.8	3.9	1.9	2.8
N3	3.0	9.9	5.9	6.9	19.0	74.0	11.0	2.6	2.9	6.1	6.1	
F.F.	3.4	5.2	8.3	10.1	25.1	22.0	18.7	7.6	4.2	3.0	3.2	

Spread - 300 ft.
Freq. - 4.425 Hz
Operator - R. Fernholm
Date - Aug 3, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 55N PSEUDO-SECTION
1 in = 600 ft.

10W 7W 4W 1W 2E 5E 8E 11E 14E 17E 20E 23E 26E 29E

N 1	528	1026	900	1069	497	148	259	896	2330	1897	2900	604	
N 2	956	986	771	721	226	290	785	1200	1491	3200	1008	475	ρ/2π OHM FEET
N 3	818	1069	435	318	372	725	882	648	2234	1327	675	367	

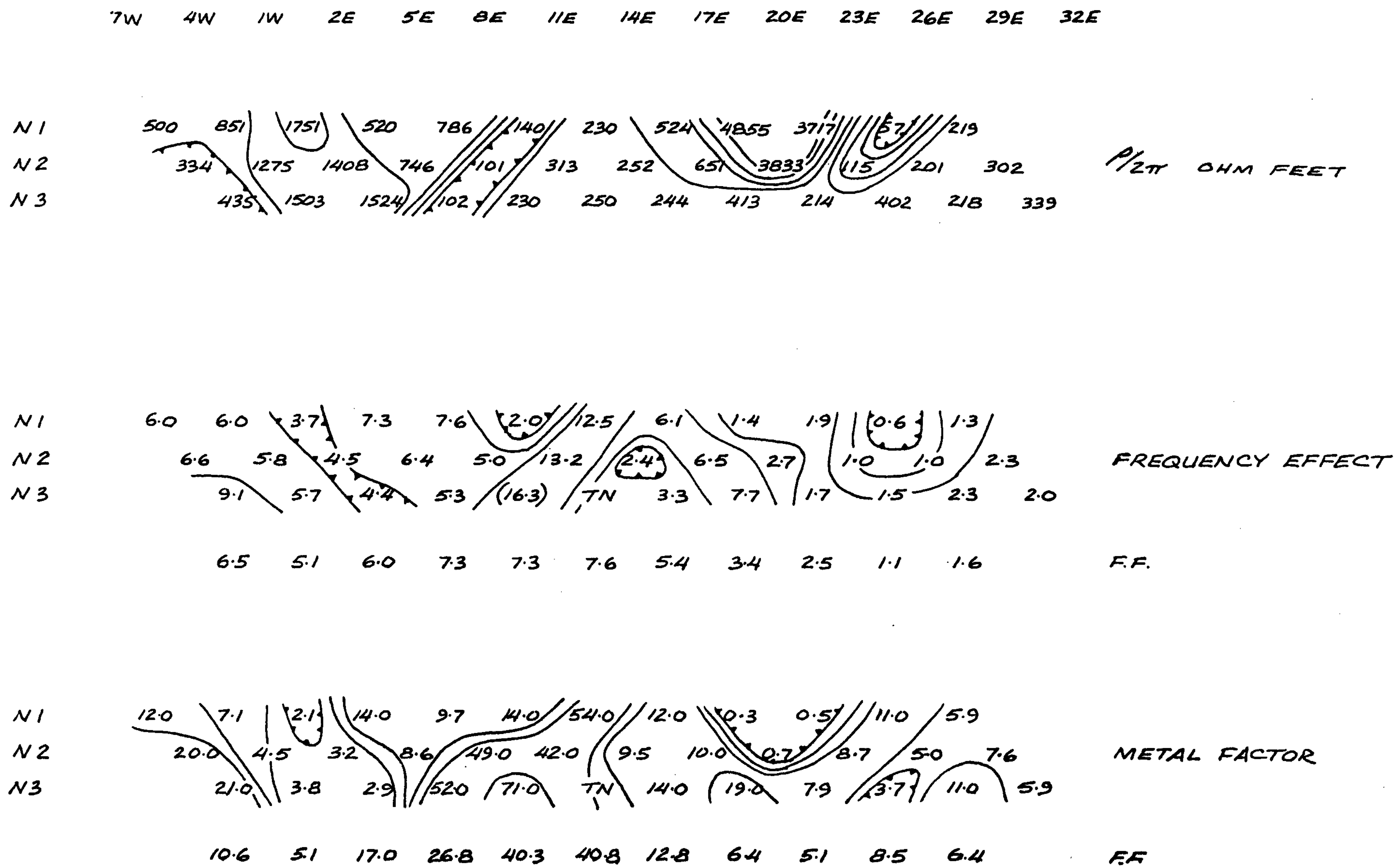
N 1	4.0	4.2	6.7	4.8	4.1	1.9	1.0	3.0	3.7	4.7	3.7	5.8	
N 2	3.8	5.8	6.3	3.6	2.8	(1.3)	2.3	3.2	6.9	4.6	4.3	5.9	FREQUENCY EFFECT
N 3	5.4	4.9	5.4	2.2	(2.8)	3.2	2.1	5.6	6.0	4.9	4.0	4.6	
	4.7	6.0	4.6	3.6	2.2	1.8	3.1	4.4	5.3	4.4	5.1		F.F.

N 1	7.6	4.1	7.4	4.5	8.3	13.0	3.9	3.3	1.6	2.5	1.3	9.8	
N 2	4.0	5.9	8.2	5.0	12.0	4.0	2.9	2.7	4.6	1.4	4.3	12.0	METAL FACTOR
N 3	6.6	4.6	12.0	6.9	7.5	4.4	2.4	8.6	2.7	3.7	5.9	13.0	
	4.9	7.4	6.3	8.5	9.2	4.1	3.7	3.3	3.5	2.8	8.5		F.F.

Spread - 300 ft.
Freq. - 44.25 Hz.
Operator - R. Fernholm
Date - Aug. 3, 4, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 65N PSEUDO-SECTION
1 in. = 600 ft.



Spread - 300 ft
Freq. - 44.25 Hz
Operator - R. Fernholm
Date - Aug 4, 1981

F.F. - Fraser Filter Value
( ) - Noisy Reading
NR - Too Noisy to Read

TECK EXPLORATIONS LTD.
SKEETER LAKE AREA
PHOENIX DIAPOLE-DIAPOLE I.P. SURVEY
LINE 75N PSEUDO-SECTION
1 in = 600 ft.

APPENDIX II

PERSONNEL AND DATES

PERSONNEL AND DATES

The following personnel were employed for purposes of the survey:

1. Phoenix Geophysics Limited
   214 - 744 West Hastings Street
   Vancouver, B. C.

   R. Fernholm, geophysical operator
   11½ days - July 23-August 4, 1981

   K. Irving, geophysical assistant
   11½ days - July 23-August 4, 1981

2. Teck Explorations Limited
   1199 West Hastings Street
   Vancouver, B. C.

   A. I. Betmanis, project supervision
   4 days - July 21-August 4

   I. Quock, line cutting 3 days - July 22-July 23
   assist survey 5 days - July 23-July 31

   S. Hawkins, line cutting 7 days - July 21-July 28
   assist survey 7 days - July 29-August 4

   W. Clem, line cutting 10 days - July 21-July 31
   assist survey 4 days - August 1-August 4

   A. Hawkins, line cutting 6 days - July 22-July 31
   assist survey 2 days - July 23-July 24

APPENDIX III

COST OF SURVEY

<u>COSTS OF SURVEY</u>

Phoenix Geophysics Ltd. Contract Charges	
11½ operating days @ $675/day	$ 7,762.50
Mobilization-demobilization	2,540.00
Telephone	40.25
Supervision (Teck Explorations Ltd.)	
A. I. Betmanis 4 days @ $200/day	800.00
Line Cutting (Teck Explorations Ltd.)	
26 man-days @ $65/day	1,690.00
Survey Assistance (Teck Explorations Ltd.)	
18 man-days @ $65/day	1,170.00
Camp Costs (Schaft Creek Camp)	
71 man-days @ $30/day	2,130.00
Helicopter Charges (Quasar Aviation Ltd.)	
15.5 hours @ $375.00/hour dry	5,812.50
Fuel - 23 gal./hour @ $5.00/gal. on site	1,782.50
Report Preparation and Miscellaneous	800.00
TOTAL	$ 24,527.75

The above costs are direct survey related costs applicable for assessment credits to the Skeeter Group of mineral claims.

A. I. Betmanis, P.Eng.

APPENDIX IV

LIST OF CLAIMS

LIST OF CLAIMS

Claims	Record Numbers	Date of Record
Swamp (12 units)	1306	17 June
Side Hill (6 units)	1307	17 June
Hill (1 unit)	1308	17 June
P 1-3	71311-13	11 June
P 5-13	71315-23	11 June
P 15-53	71325-63	11 June
P 57 Fr-59 Fr	71367-69	11 June
BB 1-10	42403-12	16 March
BB 12	42414	16 March
BB 21-30	42423-32	16 March
BB 80 Fr	42482	16 March
LL 21 Fr	53018	2 August
LL 22 Fr	53019	2 August
X-Ray 1	71752	20 August
X-Ray 2	71753	20 August
Dave 11 Fr	46013	10 August

The above claims are contiguous and comprise the Skeeter Group of Mineral Claims, grouped August 11, 1981

APPENDIX V

NOTES ON DIPOLE-DIPOLE SURVEYING

NOTES ON DIPOLE-DIPOLE INDUCED POLARIZATION AND RESISTIVITY SURVEYING

The theories and methods of dipole-dipole induced polarization surveying have been well documented in various publications and most survey reports produced by McPhar Geophysics Ltd. and Phoenix Geophysics Ltd. The various procedures of surveying and data presentation are therefore well established and need no further elaboration.

The induced polarization effect does not distinguish between various metallic minerals, eg. chalcopyrite and pyrite, but it does respond with different intensity to various minerals. Molybdenite, an economically important sulphide mineral, will give a weak I.P. effect, whereas magnetite, an oxide, may give as good a response as pyrite, chalcopyrite or pyrrhotite. Other non-sulphide minerals, such as graphite or bentonite may give good I.P. effects. Therefore, induced polarization anomalies should be evaluated in conjunction with geological, geochemical, and other geophysical surveys, if possible, prior to testing. Not infrequently in porphyry copper and/or molybdenum environments I.P. effects will be moderate in ore zones, but may be strongly anomalous at adjacent pyritic zones.

Dipole-dipole surveys often give better resolution and definition to anomalies than other electrode arrays. However, the data obtained are affected more by the electrode separation than the electrode spread lengths (see Figure 1) due to the increasing volume of rock between transmitting and receiving electrodes at increasing electrode spread lengths.

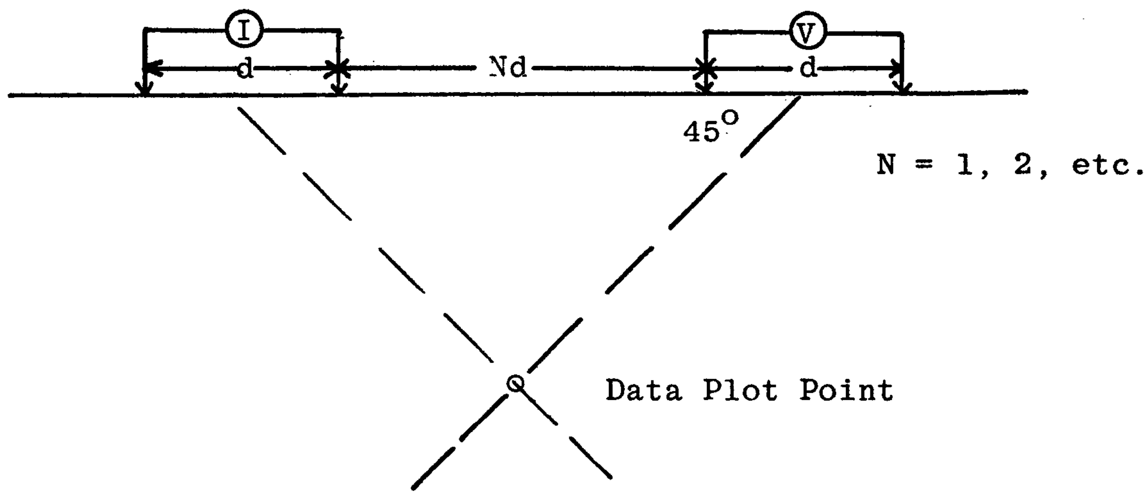


FIGURE 1: Dipole-Dipole Electrode Array

d = Electrode separation
N = Electrode spread length

Deeper penetration can be achieved more effectively by increasing electrode spread lengths beyond three times electrode separation. Values obtained from surveys of different electrode separations are compatable, and can be plotted on the same pseudo-sections and can be interpreted with values of other dipole-dipole surveys.

The target producing an anomalous value can be located within a distance of only one electrode separation, and the electrode separation should not be larger than five times the width of the expected target for narrow sulphide zones. To ensure that a target is located with the dipole-dipole array, the data plot point (Figure 1) should be at a depth of at least twice the depth to top of target, ie. (N+1)d should be at least twice the distance to top of target. To ensure complete penetration of a target by a test hole, the test hole should penetrate a depth equivalent to approximately 3.5 times the electrode separation. Any deeper target is unlikely to be reflected in the I.P. survey. Therefore, using an electrode separation of 300 feet and surveying to an electrode spread of N = 3, a target which produces an anomaly should be adequately intersected with a hole to 1,050 feet. Presuming the same 300 feet electrode separation survey, and anomalous values being picked up on all three N levels from a fairly narrow target, a test hole drilled to only 300 feet may possibly miss the target due to insufficient resolution of the dipole-dipole array.

APPENDIX VI

SUMMARY OF DIPOLE-DIPOLE FILTERING

SUMMARY OF DIPOLE-DIPOLE INDUCED POLARIZATION FILTERING FOR CONTOUR MAP PRESENTATION

A filtering technique has been developed by D.C. Fraser by which raw dipole-dipole data of apparent resistivity, apparent frequency effect, and apparent metal factor as commonly presented on pseudo-sections can be converted to single filtered outputs which can be plotted at the mid-point between transmitting and receiving electrodes at N = 1 (See Figure 1, Appendix V), and which are suitable for contouring in plan.

Due to induced polarization measurements being essentially an averaging process, anomalous values often are displaced laterally on the pseudo-sections, and the location of anomalies and their intensity are qualitatively interpreted. The Fraser filtering method produces filtered values which can be used quantitatively relative to each other, and which can be contoured such that the most anomalous values overly the more intensely induced polarization susceptive zones.

Various filter window shapes have been tried during the development of the filtering process. The triangular filter window with a 45° cut-off downwards systematically either side of the plotting point (Figure 2) is most effective for pseudo-section anomalies obtained from thin steeply dipping bodies. The same window shape has been found to be suitable for most body shapes surveyed by the dipole-dipole electrode array.

The filtering technique is applied by first obtaining intermediate filter outputs from the psuedo-sections by averaging values within the filter window at each level of electrode separation (Figure 3). Therefore at N = 1 the single value is used unaltered; at N = 2 the two adjacent values symmetrical about the N = 1 value are averaged; and at N = 3 the three adjacent values symmetrically under N = 1 are averaged; etc. to obtain intermediate filter outputs. If there are no values, as in the case of readings too noisy to be used, or as at the end of section lines, the missing values are disregarded, and the intermediate filter value reflects a fewer number of values. The final filter output is obtained by averaging intermediate outputs within the window (Figure 4). These can be plotted at N = 1 data plot position and contoured in plan.

References:

Fraser, D. C.(1981): Contour Map Presentation of Dipole-dipole Induced Polarization Data in Geophysical Prospecting, Vol. 29, pp 639-651

Fraser, D. C.(1981): A Review of Some Useful Algorithms in Geophysics in CIM Bull., Vol.74, No. 828, pp 76-83.

	1W		2E		5E		8E		11E		14E
N = 1		4.5		8.3		13.0		3.9		3.3	
N = 2	8.2		5.0		14.6		8.4		4.8		2.6
N = 3		12.0		10.8		7.5		4.5		2.5	

FIGURE 2: Pseudo-section of Dipole-dipole Metal Factor Data showing filter window at line station 6+50E

	1W		2E		5E		8E		11E		14E
N = 1		4.5		8.3		13.0		3.9		3.3	
N = 2		6.6		9.8		11.5		6.6		3.7	
N = 3		11.4		10.1		7.6		4.8		3.5	

FIGURE 3: Intermediate Filter Outputs at N = 1, N = 2, N = 3

1W		2E		5E		8E		11E		14E
	7.5		9.4		10.7		5.1		3.5	

FIGURE 4: Final Filter Outputs Suitable for Contouring.

NOTES

1. LINES 10 S, 50 N, 80 N, and 130 N SURVEYED SEPT. 1973 BY McPHAR GEOPHYSICS LTD.
2. LINES 5 S, 5 N, 15 N, 25 N, 35 N, 45 N, 55 N, 65 N, 75 N SURVEYED JULY-AUG. 1981 BY PHOENIX GEOPHYSICS LTD.
3. LINES 35 S, 25 S, 15 S, 85 N, 95 N, 105 N, 115 N, 125 N SURVEYED AUG. 1981 BY PHOENIX GEOPHYSICS LTD.
4. MINERALIZATION INDICATED BASED ON OUTCROP GEOLOGICAL MAPPING JUNE - JULY 1971 BY HECLA OPERATING COMPANY

LEGEND

2.3 3.0 — FRASER FILTER OF FREQUENCY EFFECT
10.2 8.7 — FRASER FILTER OF METAL FACTOR

Py Pyrite
Cp Chalcopyrite
Mag Magnetite
Hem Hematite

FREQUENCY EFFECT CONTOURS AT 3.5, 5.0, 7.0 FILTERED %
METAL FACTOR CONTOURS AT 10, 20, 30 FILTERED VALUES
● PROPOSED DIAMOND DRILL HOLE

TECK EXPLORATIONS LTD.

SKEETER LAKE

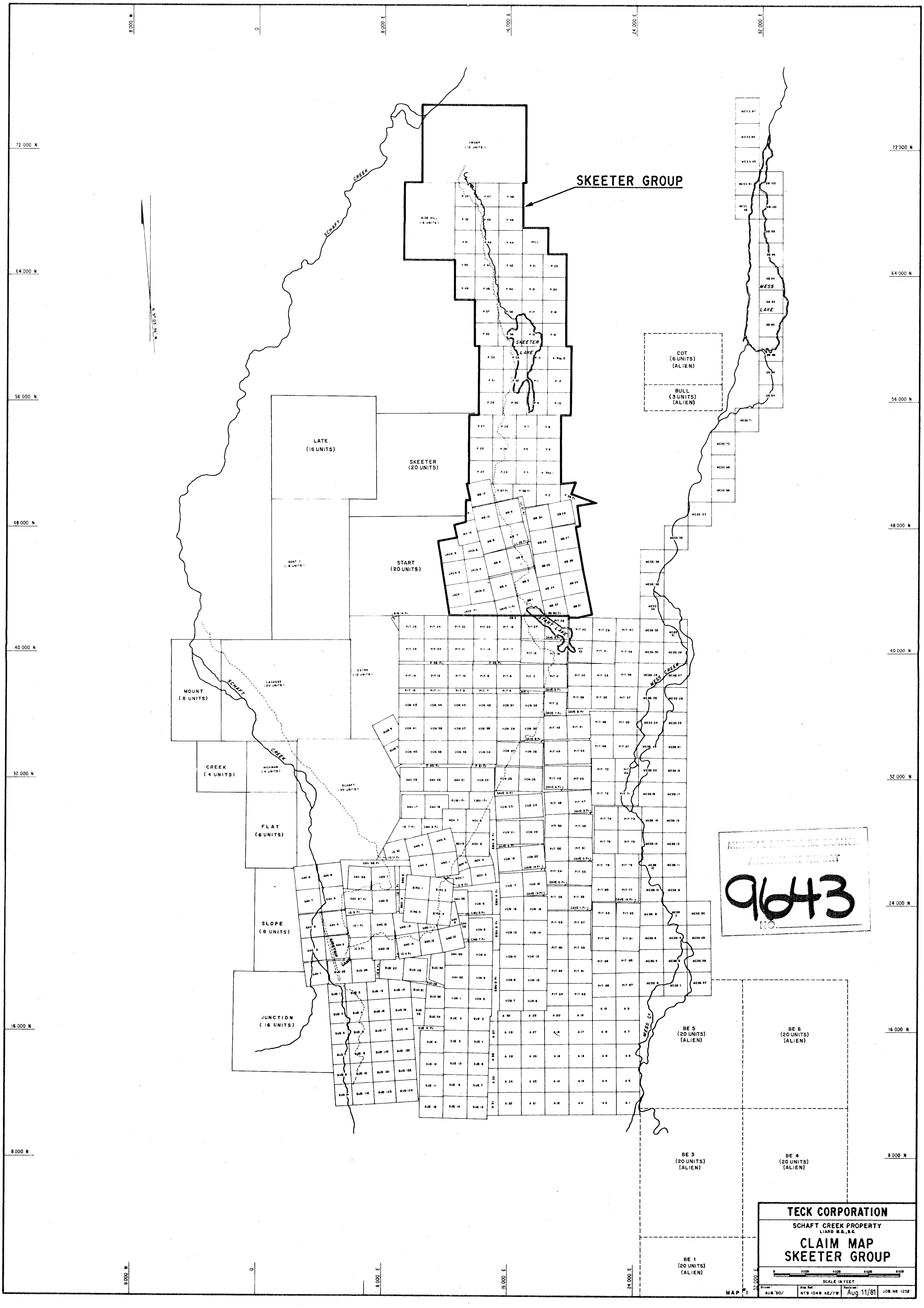
I P SURVEY
1981

SKEETER GROUP (P CLAIMS) LIARD M.D., B.C.

0 400 800 1200 ft
1" = 400'

OCTOBER 1981

N.T.S. 104 G/7W



SKEETER GROUP
SWAMP (12 UNITS)
SIDE HILL (6 UNITS)
SCHAFT CREEK
SKEETER LAKE
MESS LAKE
COT (6 UNITS) (ALIEN)
BULL (3 UNITS) (ALIEN)
LATE (16 UNITS)
SKEETER (20 UNITS)
START (20 UNITS)
START LAKE
MOUNT (8 UNITS)
CREEK (4 UNITS)
FLAT (6 UNITS)
SLOPE (8 UNITS)
JUNCTION (16 UNITS)
MESS CREEK
BE 5 (20 UNITS) (ALIEN)
BE 6 (20 UNITS) (ALIEN)
BE 3 (20 UNITS) (ALIEN)
BE 4 (20 UNITS) (ALIEN)
BE 1 (20 UNITS) (ALIEN)
72 000 N
64 000 N
56 000 N
48 000 N
40 000 N
32 000 N
24 000 N
16 000 N
8 000 N
8 000 W
0
8 000 E
16 000 E
24 000 E
32 000 E
9643
TECK CORPORATION
SCHAFT CREEK PROPERTY
LIARD M.D., B.C.
CLAIM MAP
SKEETER GROUP
SCALE IN FEET
AUG '80
NTS 104G 6E/7W
Aug. 11/81
JOB No 1252
MAP #1