A GEOPHYSICAL REPORT ON A GROUND MAGNETOMETER, VLF-EM AND HORIZONTAL LOOP EM SURVEY

ON THE MCNEIL CREEK PROPERTY
FORT STEELE MINING DIVISION
CRANBROOK, BRITISH COLUMBIA

LATITUDE 49°21'NORTH
LONGITUDE 115°59'WEST
N.T.S. 82F/8 and 82G/5

FOR

DRAGOON RESOURCES LTD.

BY

John Lloyd, M.Sc., P. Eng.
LLOYD GEOPHYSICS LIMITED

JULY 1988

LLOYD GEOPHYSICS LIMITED

SUMMARY

During the period June 9 to July 1, 1988 Lloyd Geophysics Limited carried out ground magnetometer, VLF-EM and Horizontal Loop EM surveys on the McNEIL CREEK property near Cranbrook, British Columbia for Dragoon Resources Ltd. Some 31 kilometres of each type of survey was completed.

The magnetometer survey outlined a strong anomaly which is worthy of additional exploration by trenching and drilling.

The VLF-EM survey failed to detect previously discovered NW-SE shear zones by virtue of the fact that there was no transmitting station suitably located so as to provide adequate coupling with these shear zones. Elsewhere a number of weak VLF-EM conductors were detected.

A number of possible horizontal loop EM conductors were identified. There is no reasonable correlation between the weak VLF-EM conductors and the possible horizontal loop EM conductors.

No drilling is recommended for either the VLF-EM or the horizontal loop EM conductors until correlation between the geochemical survey data and the known surface geology has been attempted.

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1. INTRODUCTION

During the period June 9 to July 1, 1988 Lloyd Geophysics Limited carried out ground magnetometer, VLF-EM and horizontal loop EM surveys on the NCNEIL CREEK property for Dragoon Resources Ltd. The property comprises parts of the SUNNY, RAM and MAR claim groups.

Approximately 31 kilometres of magnetometer, 31 kilometres of VLF-EM and 31 kilometres of horizontal loop EM were completed on the property.

2. PROPERTY LOCATION AND ACCESS

The property is located in the Fort Steele Mining Division of British Columbia and consists of 140 units as follows:

Claim Name	Record Number	Expiry Date
SUNNY 1	3049	Feb. 1989
SUNNY 2	3050	Feb. 1989
SUNNY 3	3051	Feb. 1989
SUNNY 4	3052	Feb. 1989
SUNNY 5	3053	Feb. 1989
SUNNY 6	3054	Feb. 1989
RAM 1	1730	Nov. 1988
RAM 2	1731	Nov. 1988
MAR 3	765	Sept. 1988
MAR 4	2984	Sept. 1988

The claims are located in the Moyie Range, 35 kilometres southwest of Cranbrook at latitude 49°21'N and longitude 115°59'W. See Figure 1.

LOCATION MAP

MCNEIL CREEK PROPERTY

Lat. 49°21'North
Long.119°59'West
NTS 82F/8 and 82G/5

FIGURE 1

Access to the property is by Highway 3 for 10 kilometres southwest of Cranbrook to Lumberton and then via a 25 kilometre gravel road. The claims are at elevations of between 1600 and 2200 metres, where terrain is partly logged at upper elevations and densely timbered with second growth at lower elevations.

3. GEOLOGY

The property has been mapped by Mr. Peter Klewchuk, who provided a 1:5000 surface geology map of the property to assist in the preparation of this report.

Bedrock exposures are sparse and tend to be along roads. The property is underlain by the Aldridge Formation of Middle Proterozoic Age including the Middle-Lower contact at 500 to 800 metres below surface. The Sullivan orebody at Kimberley occurs just below this contact.

The Middle Aldridge Formation comprises relatively flat-lying, thin to very thick bedded metamorphosed siltstones and quartzites. A series of northwest-southwest shear/fault zones with quartz veins cut the stratigraphy at high angles.

One intrusive, a diorite or gabbro sill, strikes approximately north-south through the central portion of the property. Locally there are phases of the diorite intrusions which contain considerable magnetite. Cretaceous felsic intrusions can also be magnetic.

4. PURPOSE OF THE GEOPHYSICAL SURVEYS

The purpose of the selected geophysical surveys was to outline for drilling and/or trenching any of the following targets which could be reasonably expected to occur on the property. These geophysical targets are described by company geologist Mr. Eric MacDonald as follows:

1) Galena, sphalerite, silver vein systems some of which are exposed in outcrop on the property and are similar to the Vine property of Cominco Ltd. These targets could be expected to contain 100,000 to 200,000 tons with lead ranging from 10% to 60% and containing only minor amounts of zinc and iron sulphide. Only minor amounts have been exposed on surface outcrops and these have been variable in grade, width and strike continuity.

2) Mineralized shear zones, ranging from 200,000 to 1,000,000 tons of 15 to 20% Pb, 5 to 10% Zn and 10 to 15% iron as sulphides.

3) A flat lying stratiform massive sulphide deposit similar to that of the Sullivan ore zone containing 1 to 10 million tons grading approximately 5% Pb, 5% Zn, and 10 to 20% iron as sulphides.

4) Fissure vein gold deposits of variable dimensions possibly in the range of 10,000 to 30,000 tons containing 0.3 oz/ton to 1.0 oz/ton Au.

5) A crackle breccia type gold deposit of undetermined size relating to a syenite intrusive in the northeast corner of the grid.

5. INSTRUMENT SPECIFICATIONS

5.1 Magnetometer/VLF-EM Equipment

The equipment used was the OMNI PLUS combined magnetometer/ VLF-EM system manufactured by EDA Instruments Inc., Toronto, Canada.

The system is completely software/microprocessor controlled. A portable proton precession magnetometer measures and stores in memory the total earth's magnetic field at the touch of a key. It also identifies and stores the location and time of each measurement and computes the statistical error of the reading and stores the decay and strength of the signal being measured. Throughout each survey day a similar base station magnetometer measures and stores in memory the daily fluctuations of the earth's magnetic field. The use of two magnetometers eliminates the need for a network of base stations on the grid. At the end of each day the field data is merged with the base station data in the computer and automatic diurnal corrections are applied to correct the total field data.

The VLF-EM hardware of the OMNI PLUS system has the ability to measure, both the VLF magnetic and electric fields from at least two different transmitting stations. The system requires no operator orientation of the sensor head towards the transmitting stations. This is achieved by the utilization of three orthognal sensor coils rather than the two sensor coils used in conventional systems.

5.2 Horizontal Loop E.M. Equipment

The equipment used was a portable MAXMIN I ground EM system manufactured by APEX PARAMETRICS LIMITED, Toronto, Canada.

It is an expansion of the popular MAXMIN II and MAXMIN III systems.

Both receiver and transmitter coils are maintained a fixed distance apart and moved in unison from station to station. In the Horizontal Loop mode, as used in this survey, both the receiver and the transmitter coils are maintained horizontal and coplanar and are joined by a reference cable.

The equipment can be operated at 110, 220, 440, 880, 1760, 3520, 7040 and 14080 Hz with coil separations of 12.5, 25, 50, 100, 125, 150, 200, 250, 300 and 400 metres. Both the in-phase and quadrature components of the secondary magnetic field in % of the primary or transmitted field are measured at each station and plotted at the mid-point between the receiver and transmitter coils.

6. SURVEY SPECIFICATIONS

6.1 Magnetometer Survey

This survey was carried out on lines 200 metres apart and readings were taken at 12.5 metre station intervals. In one strongly anomalous area additional lines were surveyed so that the coverage was completed on lines 100 metres apart in this area.

6.2 VLF-EM Survey

This survey was carried out on lines 200 metres apart and readings were taken at 12.5 metre station intervals. In the area of strong magnetic relief, lines 4100N and 4200N were also surveyed so that coverage was completed on lines 100 metres apart in this area.

Two transmitter stations were selected for this survey:

(a) Seattle, Washington, USA (NLK 24.8 kHz)
(b) Cutler, Main, USA (NAA 24.0 kHz)

6.3 Horizontal Loop EM Survey

This survey was carried out on lines 200 metres apart. Readings were taken every 25 metres using a coil separation of 75 metres. Two transmitter frequencies were used viz. 880 and 1760 Hz. Additional lines, 3900N 4100N and 4200N were also surveyed, so that coverage was completed on lines 100 metres apart in this area.

7. DATA PROCESSING

The data collected was processed in the field using a portable Compaq 286 Computer and an Epson printer.

Using appropriate software, the magnetic field data was corrected for diurnal variations by merging it with the base station magnetic data.

The VLF-EM data was automatically downloaded from the field instrument to the computer. The Horizontal Loop EM data was entered to the computer manually via the keyboard.

For data integrity checks and for a quick review of anomalies all geophysical data was plotted out in profile form on the Epson printer.

Final preparation of maps was carried out in the Vancouver office on an E size (34" x 44") Hewlett Packard plotter.

8. DATA PRESENTATION

The data obtained from the survey described in this report are presented on 6 maps as follows:

Description	Dwg. No.
Total Magnetic Field Profiles	88269-1
Total Magnetic Field Contours	88269-2
VLF-EM Profiles (Seattle)	88269-3
VLF-EM Profiles (Cutler)	88269-4
MaxMin HLEM Profiles (880 Hz)	88269-5
MaxMin HLEM Profiles (1760 Hz)	88269-6

9. DISCUSSION OF RESULTS

9.1 Magnetometer Survey

This survey detected a strong magnetic anomaly on the northern corner of the grid on lines 4000N, 4100N and 4200N. The anomaly is approximately 700 to 1000 nT above background and is open to the north. It lies directly west of a north south striking diorite sill, which appears to have little or no magnetic signature. It is therefore reasonable to assume that the anomaly is either caused by a different rock type or if indeed the diorite sill is the cause, then its magnetite content is sharply increased on this part of the grid. Regardless of this, the magnetic anomaly is worthy of further exploration.

The remainder of the property is singularly uninteresting from a magnetic point of view, with variations of less than 20 nT occurring over more than 90% of the property.

9.2 The VLF-EM Survey

Before describing the results from this survey, mention should be made about the limitations imposed upon the method arising from the use of fixed location transmitting stations.

The field generated by VLF transmitting stations is primarily horizontal and the direction of this horizontal field is perpendicular to the direction of the transmitting station. Therefore to obtain maximum coupling with a geological conductor it is necessary to select a transmitting station whose direction is co-linear with the geological strike of the conductor.

At first this would seem fairly straight forward since there are generally two or three stations to choose from. Initially we selected Annapolis, unfortunately this station went off the air on the first survey day. We switched to Cutler whose geographical direction is approximately co-linear with the geological strike of the property only to find that the direction of the primary field was approximately 90° away from the anticipated direction. We have observed this phenomenom over a period of 20 years whilst doing VLF-EM surveys. A number of explanations have been proposed to explain this phenomenon. These include distortion of the primary field due to "focussing" especially in mountainous areas. Variations in the primary field pattern with distance from the station, and a more recent explanation is that the primary field follows "great circle routes" and not true azimuth or geographic direction paths.

Based mainly on signal strength, the only two stations available to us were Seattle and Cutler. The primary fields of these two stations were virtually in opposite (180o) directions and neither were very suitable for maximum coupling with the NW-SE shear zones which are known to occur on the property from geological mapping and trenching.

The VLF-EM data obtained from both Seattle and Cutler are almost identical, and a number of very weak EM conductor axes have been identified and are plotted in Dwg. Nos. 88269-3 and 88269-4. Hopefully these very weak conductors are caused by faults or shears. However, due to their very weak nature, they may not have true bedrock sources and could be caused by conductive clays in overburden.

9.3 Horizontal Loop EM Survey

Whilst every effort was made to maintain the transmitter and receiver coils equidistant and co-planar during the course of the survey, it is clear that the rough terrain has introduced random variations in the in-phase component of about ± 5%. The quadrature component of course is not affected in this way, and remains uninterestly smooth throughout the survey area.

The axes of a number of possible EM conductors have been identified and are plotted on Dwg. Nos. 88269-5 and 88269-6. It is important to understand that these conductors may not be genuine bedrock conductors, but may in fact be caused by "noise" due to cable shortening and coil misalignment in rough terrain. Such an explanation for these increased responses is further reinforced by the fact that there is virtually no difference in the amplitude of the responses between the low frequency (880 Hz) and the high frequency (1760 Hz) in either the in-phase or quadrature measurements.

There is no reasonable correlation between the possible Horizontal Loop EM conductors and the previously described weak VLF-EM conductors.

10. CONCLUSION AND RECOMMENDATIONS

From a study of the geophysical data obtained from the various surveys described in this report is has been concluded that

A. The magnetometer survey outlined one strong anomaly in the northern part of the property which is worthy of additional exploration.

B. The VLF-EM survey failed to detect previously discovered NW-SE shear zones by virtue of the fact that there was no transmitting station suitably located so as to provide adequate coupling with the known shears and at the same time have sufficient signal strength to provide reliable measurements.

C. There is no reasonable correlation between the weak VLF-EM conductors and the possible Horizontal Loop EM conductors.

D. The Horizontal Loop EM data suffered from random variations in the in-phase component measurements caused by the rough terrain. These variations were rather small and have most probably not caused any strong conductors to go undetected.

Trenching and/or drilling is recommended for the strong magnetic anomaly located on the northern portion of the property. The drill hole locations should be guided by correlating the magnetic data with the geochemical data and the known surface geology.

No drilling is recommended for the weak VLF-EM and Horizontal Loop EM conductors that have been identified. Instead an attempt should be made to correlate the EM data with the geochemical data and known surface geology, at which time a drilling decision can be made.

Respectfully Submitted
LLOYD GEOPHYSICS LIMITED

John Lloyd

John Lloyd, M.Sc., P. Eng.
Geophysicist

July 1988
Vancouver, B.C.

APPENDIX

Personnel Employed On Survey

Name	Occupation	Address	Dates
J.Lloyd	Geophysicist	Lloyd Geophysics Limited 1110-625 Howe Street Vancouver, B.C. V6C 2T6	July 19-22/88
D. Klit	Geophysicist	"	Jun 9-Jul 1/88
M. Pearson	Instrument Operator	"	Jun 16-Jul 1/88
J. Zondag	Typist	"	July 25-26/88

Cost of Geophysical Surveys

Lloyd Geophysics contracted the data acquisition of the MAG. and VLF-EM surveys on a per kilometer basis and the HLEM survey on a per diem basis. Living and travelling expenses, computer data processing, reproduction, interpretation and report writing were extra costs. The total costs incurred by Lloyd Geophysics Limited to complete the MAG., VLF-EM and HLEM surveys was $20,762.25. The breakdown of these costs are shown below.

		MAG and VLF-EM	HLEM	TOTAL
1.	Data Acquisition	$ 5,468.00	$ 8,600.00	$ 14,068.00
2.	Truck Charges	660.00	720.00	1,380.00
3.	Living & Travel	488.92	907.98	1,396.90
4.	Final Maps and Reproduction Costs	1,194.90	1,122.45	2,317.35
5.	Interpretation and Report Writing	800.00	800.00	1,600.00
	Totals	$ 8,611.82	$ 12,150.43	$ 20,762.25

Certification of Author

I, John Lloyd, of 1110-625 Howe Street, in the City of Vancouver, in the Province of British Columbia, do hereby certify that:

1. I graduated from the University of Liverpool, England in 1960 with a B.Sc. in Physics and Geology, Geophysics Option.

2. I obtained the diploma of the Imperial College of Science and Technology (D.I.C.), in Applied Geophysics from the Royal School of Mines, London University in 1961.

3. I obtained the degree of M.Sc. in Geophysics from the Royal School of Mines, London University in 1962.

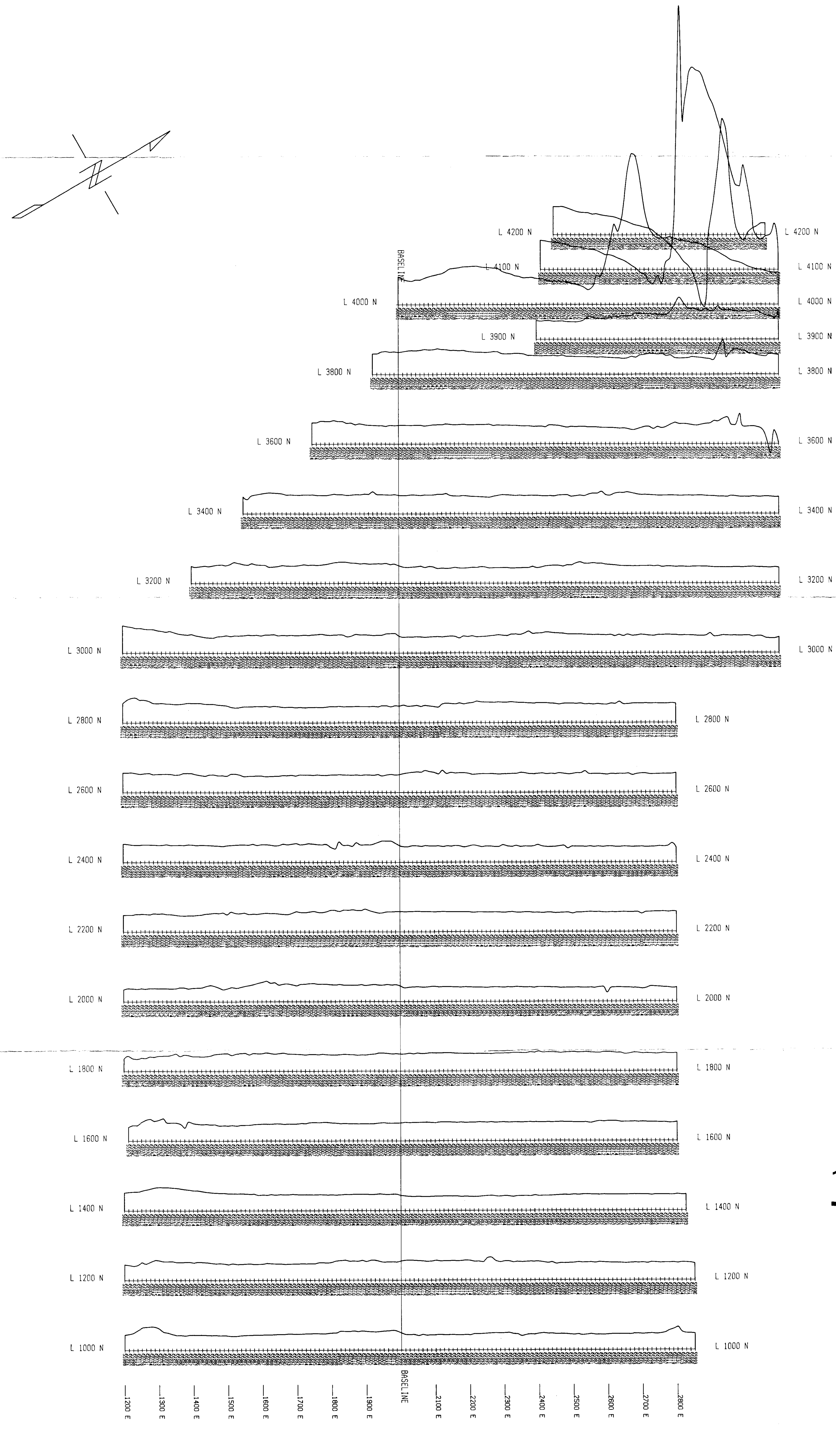
4. I am a member in good standing of the Association of Professional Engineers in the Province of British Columbia, the Society of Exploration Geophysicists of America, the European Association of Exploration Geophysicists and the Canadian Institute of Mining and Metallurgy.

5. I have been practising my profession for over twenty-five years.

John Lloyd

John Lloyd, P. Eng.

Vancouver, B.C.
July, 1988



MAGNETIC PROFILES

PROFILE SCALE : 100 nT / cm
PROFILE BASE LEVEL : 55950 nT

INSTRUMENT : EDA OMNI PLUS

SCALE 1 : 5 000

100 0 100 (metres) 200 300 400

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McNEIL CREEK PROPERTY
Cranbrook British Columbia

TOTAL MAGNETIC FIELD PROFILES

NTS 82 F/8 and 82 G/5
MAP SCALE 1 : 5000 DRAWING : 88269-1

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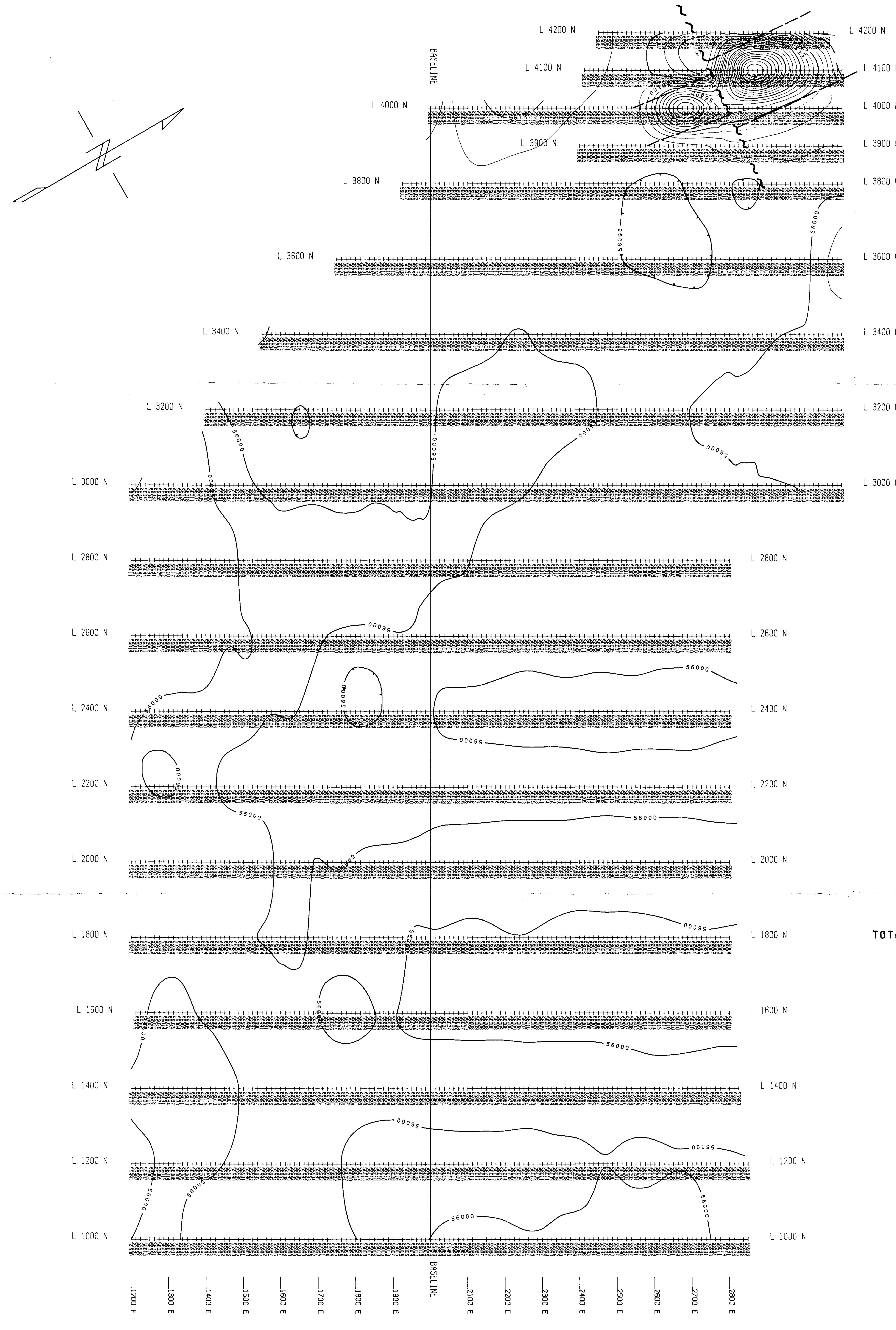


TOTAL FIELD MAGNETIC CONTOURS

BASIC CONTOUR INTERVAL : 50 nT

INSTRUMENT : EDA OMNI PLUS

FAULT (INTERPRETED)

GEOLOGICAL CONTACT (INTERPRETED)

GEOLOGICAL BRANCH
ASSESSMENT REPORT

18,117

SCALE 1 : 5 000

100 0 100 (metres) 200 300 400

DRAGOON RESOURCES LIMITED

McNEIL CREEK PROPERTY

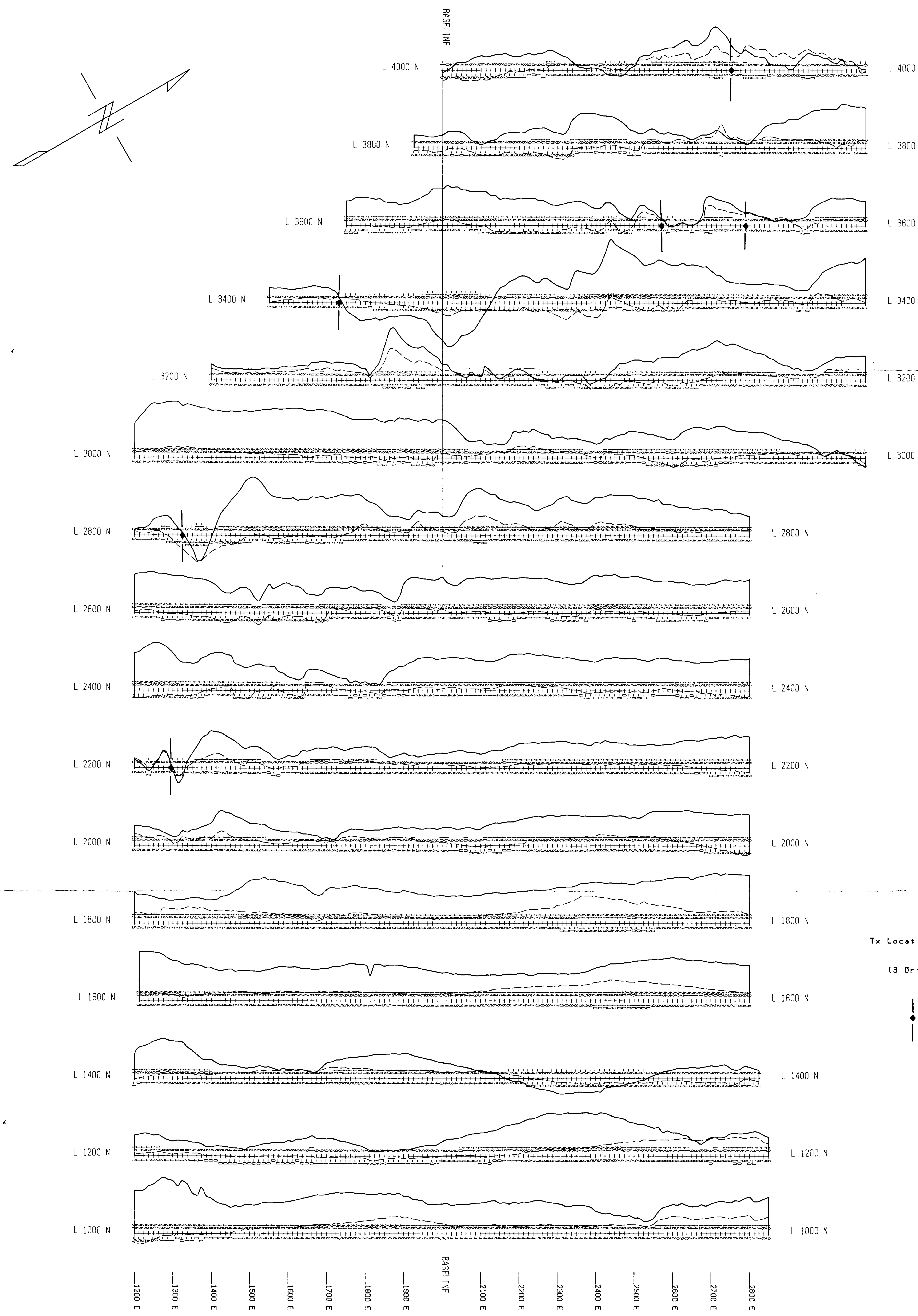
Cranbrook British Columbia

TOTAL FIELD MAGNETIC CONTOURS

NTS 82 F/8 and 82 G/5

MAP SCALE 1 : 5000 DRAWING : 88269-2

LLOYD GEOPHYSICS LIMITED



VLF - EM PROFILES

SCALE : 1 cm = 10 %

IN PHASE ——

QUADRATURE — —

POSTING IP / Q — +10 % / 0 PROFILE / -10 %

Tx Location : Seattle, Washington (NLK 24.8 kHz)

Instrument : EDA OMNI PLUS

(3 Orthogonal Rx. Coils, Tilt Compensated)

AXIS OF VERY WEAK EM CONDUCTOR

SCALE 1 : 5 000

100 0 100 (metres) 200 300 400

GEOLOGICAL BRANCH
ASSESSMENT REPORT

18,117

DRAGOON RESOURCES LIMITED

McNEIL CREEK PROPERTY

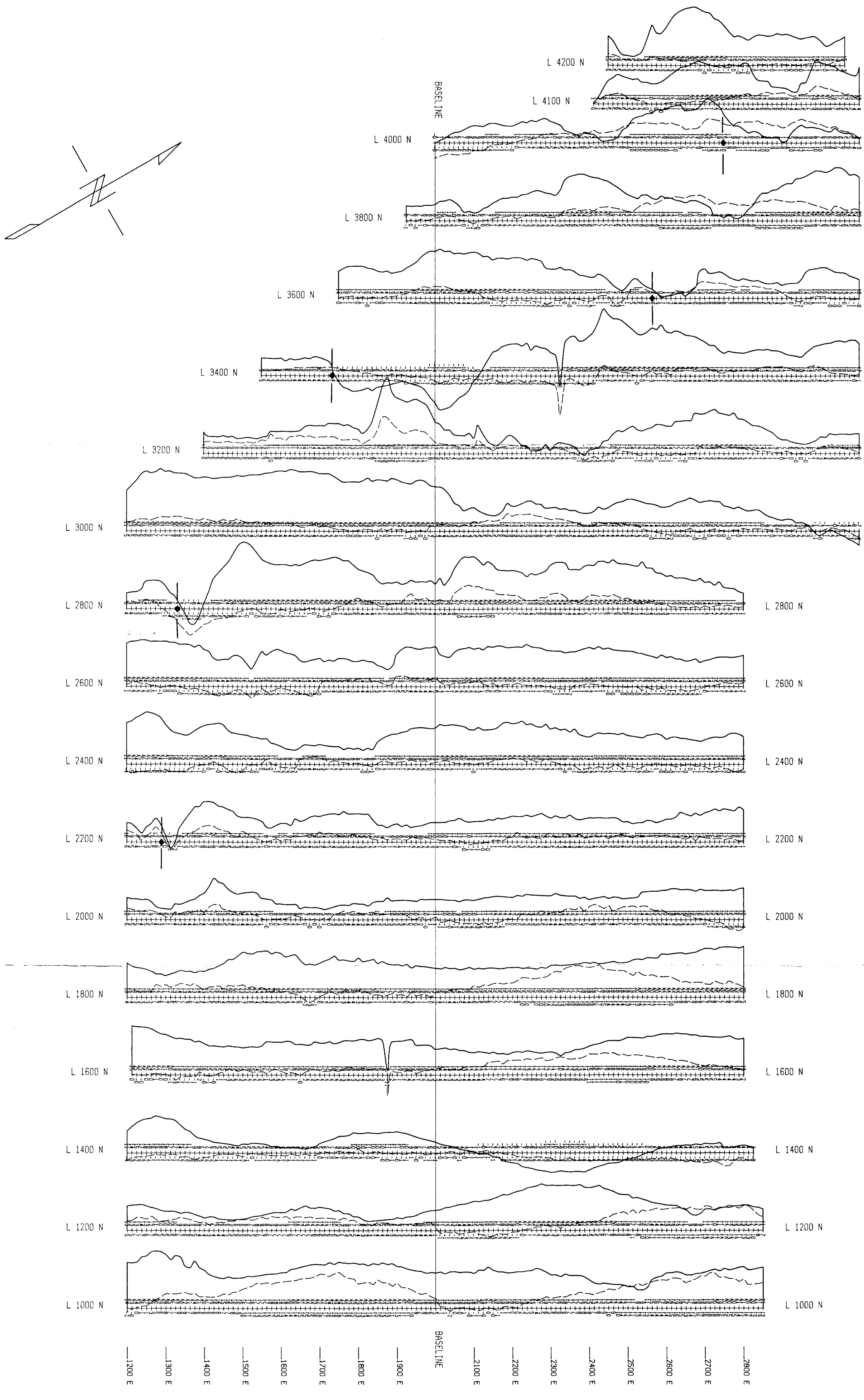
Cranbrook British Columbia

VLF-EM PROFILES

NTS 82 F/8 and 82 G/5

MAP SCALE 1 : 5000 DRAWING : 88269-3

LLOYD GEOPHYSICS LIMITED



VLF - EM PROFILES

SCALE : 1 cm = 10 %

IN PHASE
QUADRATURE

POSTING IP -8 -10 +10 +5
Q -3 -5 +5 +2
+10 % 0 PROFILE -10 %

Tx Location : Cutler, Maine (NAA 24.0 kHz)
Instrument : EDA OMNI PLUS
(3 Orthogonal Rx. Coils, Tilt Compensated)

AXIS OF VERY WEAK EM CONDUCTOR

SCALE 1 : 5 000
100 0 100 (metres) 200 300 400

GEOLOGICAL BRANCH ASSESSMENT REPORT

18,117

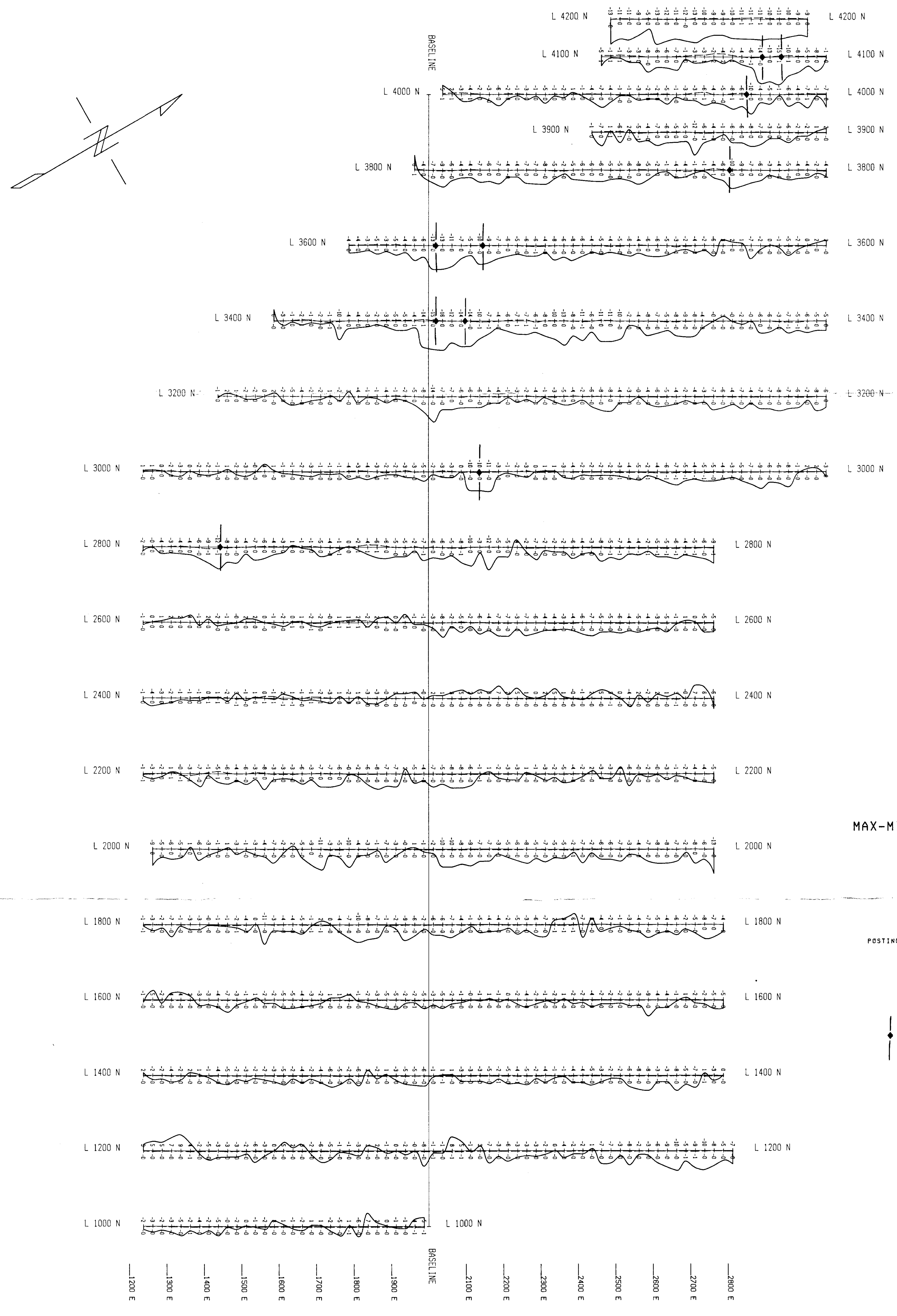
DRAGOON RESOURCES LIMITED

McNEIL CREEK PROPERTY
Cranbrook British Columbia

VLF-EM PROFILES

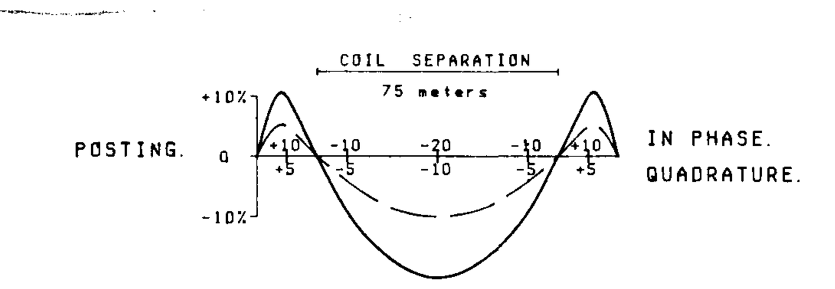
NTS 82 F/8 and 82 G/5
MAP SCALE 1 : 5000 DRAWING : 88269-4

LLOYD GEOPHYSICS LIMITED



MAX-MIN HORIZONTAL LOOP LEGEND

FREQUENCY 880 Hz
IN PHASE ———
QUADRATURE — — —



SCALE : 1 cm. = 10 %

AXIS OF POSSIBLE EM CONDUCTOR

SCALE 1 : 5 000
100 0 100 (metres) 200 300 400

GEOLOGICAL BRANCH
ASSESSMENT REPORT

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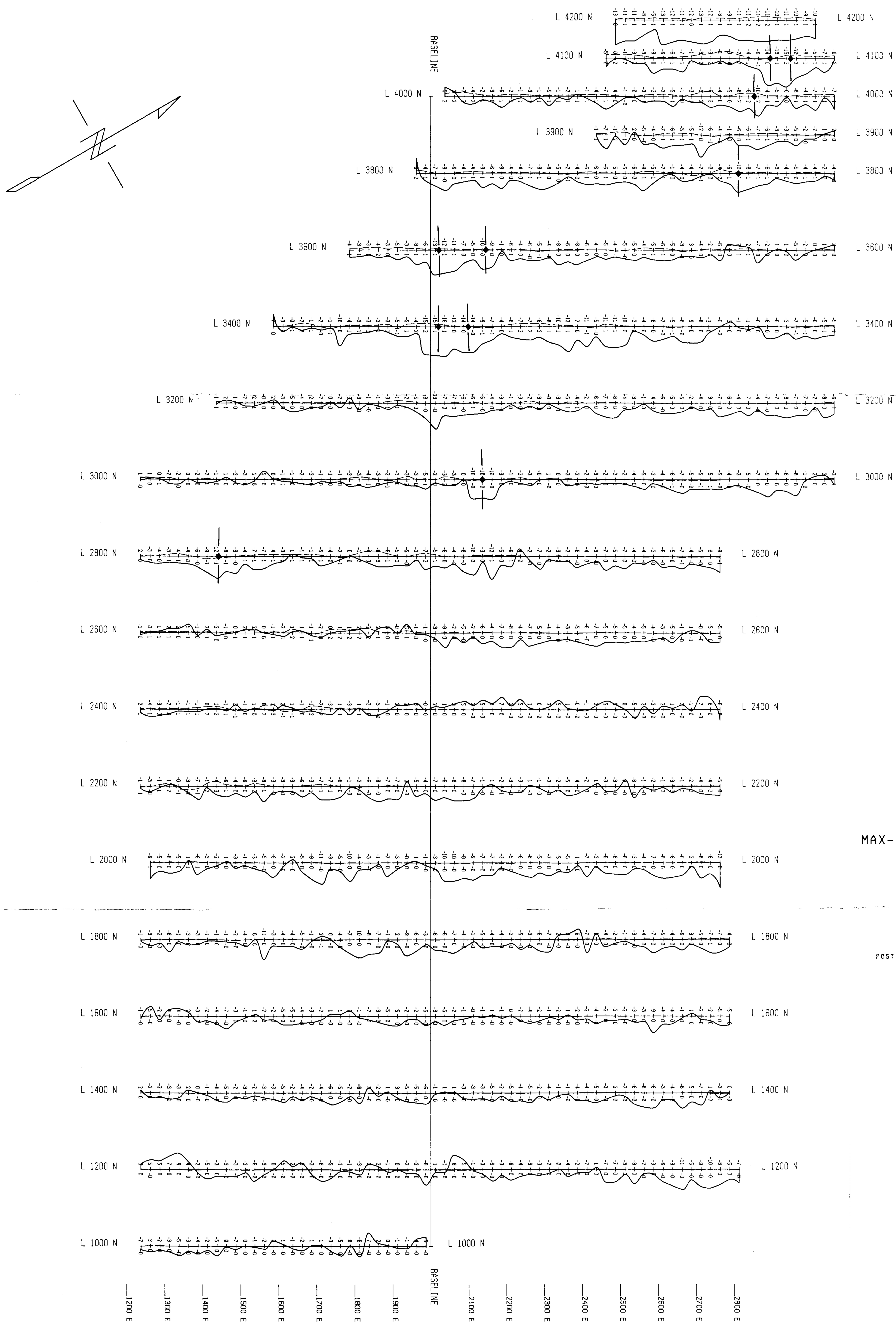
DRAGOON RESOURCES LIMITED

McNEIL CREEK PROPERTY
Cranbrook British Columbia

MAXMIN HLEM PROFILES

NTS 82 F/8 and 82 G/5
MAP SCALE 1 : 5000 DRAWING : 88269-5

LLOYD GEOPHYSICS LIMITED



MAX-MIN HORIZONTAL LOOP LEGEND

FREQUENCY 1760 Hz

IN PHASE

QUADRATURE

COIL SEPARATION 75 meters

+10%, 0, -10%

POSTING. IN PHASE. QUADRATURE.

SCALE : 1 cm. = 10 %

AXIS OF POSSIBLE EM CONDUCTOR

SCALE 1 : 5 000

100 0 100 (metres) 200 300 400

GEOLOGICAL BRANCH ASSESSMENT REPORT

18,117

DRAGOON RESOURCES LIMITED

McNEIL CREEK PROPERTY

Cranbrook British Columbia

MAXMIN HLEM PROFILES

NTS 82 F/8 and 82 G/5

MAP SCALE 1 : 5000 DRAWING : 88269-6

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