010

REPORT

ON A
COMBINED HELICOPTER-BORNE
ELECTROMAGNETIC AND MAGNETIC SURVEY

ADAMS AND ELDORADO TOWNSHIPS
TIMMINS AREA
PROVINCE OF ONTARIO
NTS 42 A/6

FOR

OUTOKUMPU MINES LIMITED
P.O. BOX 1123
TIMMINS, ONTARIO
CANADA P4N 7H9

2.16592

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J9625

PART ① of ②

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1. INTRODUCTION

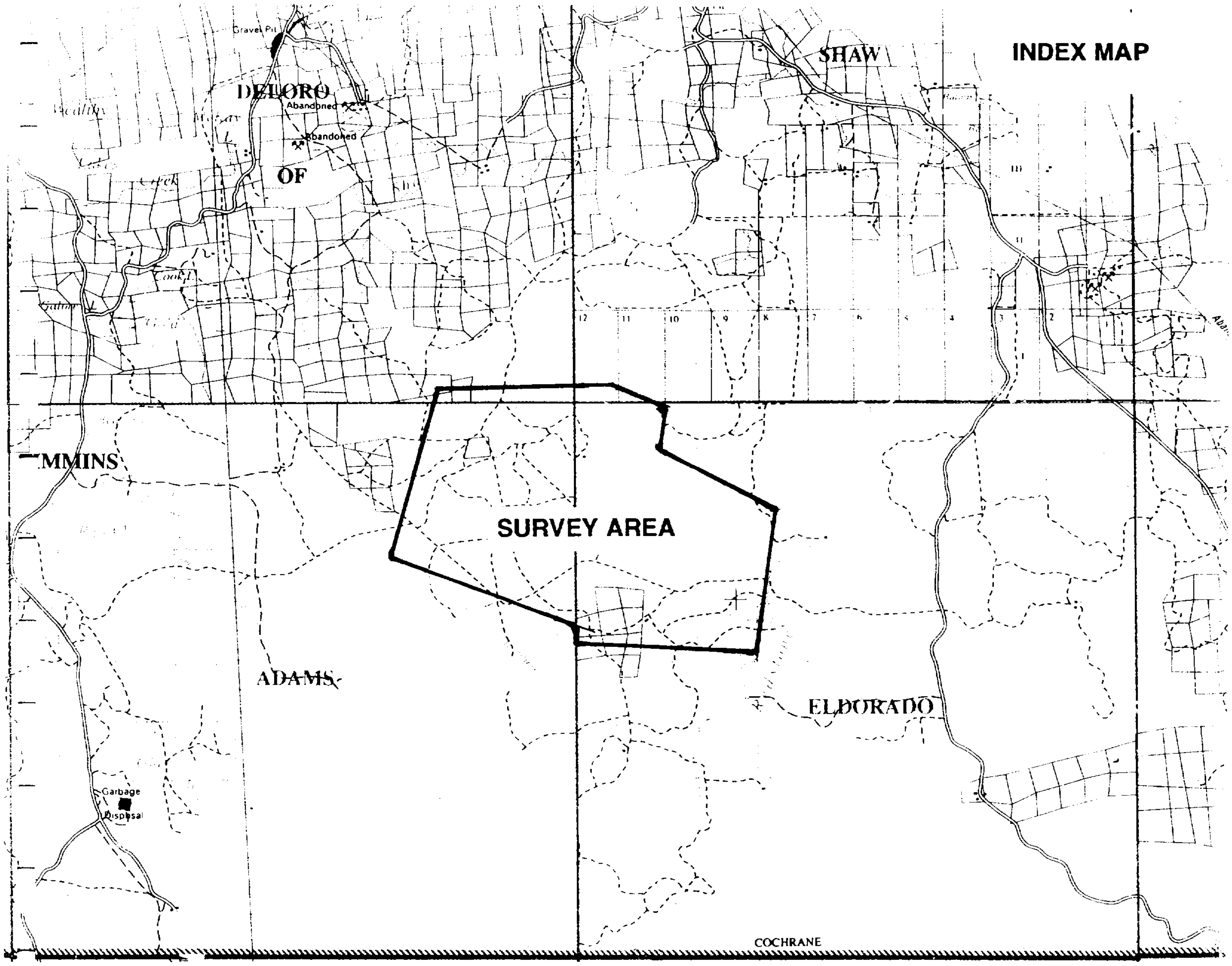
This is a report on an airborne geophysical survey carried out for Outokumpu Mines Limited by Aerodat Inc. under a contract dated March 5, 1996. Principal geophysical sensors included a three frequency electromagnetic system and a high sensitivity cesium vapour magnetometer. Ancillary equipment included a colour video tracking camera, Global Positioning System (GPS) navigation instrumentation, a radar altimeter, a power line monitor and a base station magnetometer.

The survey covered an area totalling about 17 square kilometres located 25 km southeast of Timmins. Total survey coverage is approximately 458 line kilometres including 12 kilometres of tie lines. The Aerodat Job Number is J9625.

This report describes the survey, the data processing, data presentation and method of selection of electromagnetic responses of interest. Identified electromagnetic anomalies appear on the various map products as EM anomaly symbols with interpreted source characteristics.

2. SURVEY AREA

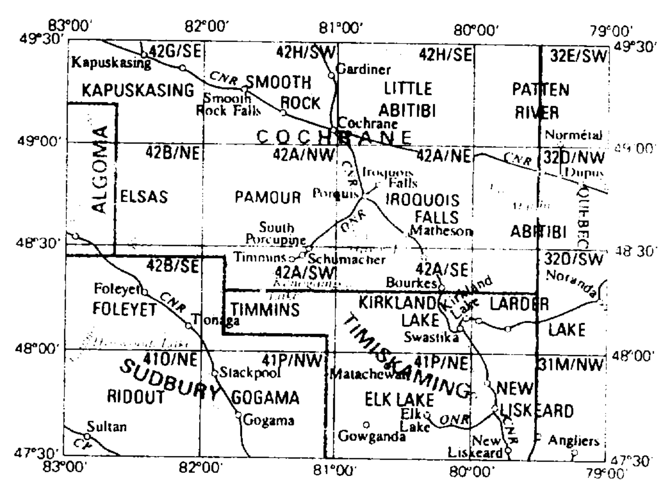
The area straddles the north part of the north-south boundary between Adams and Eldorado Townships and is bounded on the north by Deloro and Shaw Townships. Topography is shown on the 1:50,000 scale NTS map sheets 42 A/6. Local relief is very moderate. Elevations range from 275 m to over 325 m above mean sea level. The survey area is shown in the attached index map. The flight line direction is 198 degrees. Line spacing is 50 metres.



N. T. S. 42A/SW

TIMMINS

PROVINCIAL SERIES



Index to adjoining maps of the 1:100 000 series

1:100 000

1 0 1 2 3 4 5 6 7 8 9 10

One centimetre represents one kilometre

3. GENERAL SURVEY LOGISTICS

The survey was completed in the period March 27 to 28, 1996. Principal personnel are listed in Appendix III. A total of three survey flights was required to complete the project. Aircraft ground speed is maintained at approximately 60 knots (30 metres per second) and mean terrain clearance of 60 metres consistent with the safety of the aircraft and crew.

A global positioning system (GPS) consisting of a Magnavox MX 9212 operated in differential mode guides aircraft navigation and flight line control. Field processing of the differential GPS data in the field utilizes a PC using software supplied by the manufacturer. One system is installed in the survey helicopter. This involves mounting the receiver antenna on the casing ("bird") containing the magnetometer sensor. A second system acts as the base station.

The published NTS maps provide the Universal Transverse Mercator (UTM) coordinates of the survey area corners. These coordinates program the navigation system. A test flight confirms if area coverage is correct. Thereafter the navigation system guides the pilot along the survey traverse lines marked on the topographic map. The operator also enters manual fiducials over prominent topographic features. Survey lines showing excessive deviation are re-flown.

The magnetic tie line navigation is visual and, where possible, traverses cover areas of low topographic and magnetic relief. Aircraft position is registered by the navigation system. The operator calibrates the geophysical systems at the start, middle (if required) and end of every survey flight. During calibration the aircraft is flown away from ground effects to record electromagnetic zero levels.

4. AIRCRAFT AND SURVEY EQUIPMENT

4.1 Aircraft

The survey aircraft was an AS350B1 helicopter, piloted by Roger Morrow, owned and operated by Questral Helicopters Ltd. G. Lipa of Aerodat acted as navigator and equipment operator. Aerodat performed the installation of the geophysical and ancillary equipment. The survey aircraft is flown at a mean terrain clearance of 60 metres (200 feet) and speed of 60 knots.

4.2 Electromagnetic System

The electromagnetic system is an Aerodat three frequency configuration. One vertical coaxial coil pair operate at a frequency 2,539 Hz and two horizontal coplanar coil pairs at frequencies of 2,736 Hz and 33,240 kHz. The transmitter-receiver separation is 5 metres. Inphase and quadrature signals are measured simultaneously for the three frequencies with a time constant of 0.1 seconds. The HEM bird is towed 30 metres (100 feet) below the helicopter.

4.3 Magnetometer

A Scintrex H8 cesium, optically pumped magnetometer sensor, measures the earth's magnetic field. The sensitivity of this instrument is 0.001 nanoTesla at a sampling rate of 0.2 second. The sensor is towed in a bird 15 metres (50 feet) below the helicopter 45 metres (150 feet) above the ground).

4.4 Ancillary Systems

Base Station Magnetometer

A Gem Systems, Inc. GSM19 magnetometer is set up at the base of operations to record diurnal variations of the earth's magnetic field. Synchronization of the clock of the base station with that of the airborne system is checked each day to insure diurnal corrections will be accurate. Recording resolution is 1 nT with an update rate of four seconds. Magnetic field variation data are plotted on a 3" wide gridded paper chart analog recorder. Each division of the grid (0.25") is equivalent to one minute (chart speed) or five nT (vertical sensitivity). The date, time and current total field magnetic value are automatically recorded every 10 minutes. The data is also saved to digital tape.

Radar Altimeter

A King KRA-10 radar altimeter records terrain clearance. The output from the instrument is a linear function of altitude. The radar altimeter is pre-calibrated by the manufacturer and is checked after installation using an internal calibration procedure.

Tracking Camera

A Panasonic colour video camera records the flight path on VHS video tape. The camera operates in continuous mode. The video tape also shows the flight number, 24 hour clock time (to .01 second), and manual fiducial number.

Global Positioning System (GPS)

The Global Positioning System is a U.S. Department of Defense program that will provide worldwide, 24 hour, all weather position determination capability. GPS consists of three segments:

- a constellation of satellites
- ground stations that control the satellites

- a receiver

The receiver takes in coded data from satellites in view and there after works out the range to each satellite. The coded data must therefore include the instantaneous position of the satellite relative to some agreed earth-fixed coordinate system. The satellite constellation consists of 24 satellites with a proportion of the satellites acting as standby spares.

Analog Recorder

An RMS dot matrix recorder displays the data during the survey. Record contents are as follows:

LABEL	PARAMETER	CHART SCALE
MAGF	Total Field Magnetics, Fine	2.5 nT/mm
MAGC	Total Field Magnetics, Coarse	25 nT/mm
L2XI	2,539 Hz, Coaxial, Inphase	2.5 ppm/mm
L2XQ	2,539 Hz, Coaxial, Quadrature	2.5 ppm/mm
L2PI	2,736 Hz, Coplanar, Inphase	10 ppm/mm
L2PQ	2,736 Hz, Coplanar, Quadrature	10 ppm/mm
H3PI	33,240 Hz, Coplanar, Inphase	20 ppm/mm
H3PQ	33,240 Hz, Coplanar, Quadrature	20 ppm/mm
BARO	Barometer	10 ft/mm
RALT	Radar Altimeter	10 ft/mm
PWRL	60 Hz Power Line Monitor	-

Data is recorded with positive - up, negative - down. The analog zero of the radar altimeter is 5 cm from the top of the analog record. A helicopter terrain clearance of 60 m (200 feet) should therefore be seen some 3 cm from the top of the analog record.

Chart speed is 2 mm/second. The 24-hour clock time is printed every 20 seconds. The total magnetic field value is printed every 30 seconds. The ranges from the radar navigation system are printed every minute.

Vertical lines crossing the record are manual fiducial markers activated by the operator. The start of any survey line is identified by two closely spaced manual fiducials. The end of any survey line is identified by three closely spaced manual fiducials. Manual fiducials are numbered in order. Every tenth manual fiducial is indicated by its number, printed at the bottom of the record.

Calibration sequences are located at the start and end of each flight and at intermediate times where needed.

Digital Recorder

A DGR-33 data system records the digital survey data on magnetic media. Contents and update rates are as follows:

DATA TYPE	RECORDING INTERVAL	RECORDING RESOLUTION
Magnetometer	0.1 second	0.001 nT
HEM, (8 or 10 Channels)	0.1 second	
HEM, coaxial - 2539 Hz		0.03 ppm
HEM, coplanar- 2736 Hz		0.06 ppm
HEM, coplanar- 32,000 Hz		0.125 ppm
Position (2 Channels)	0.2 second	0.1 m
Altimeter	0.2 second	0.05 m
Power Line Monitor	0.2 second	
Manual Fiducial		
Clock Time		

5. DATA PROCESSING AND PRESENTATION

5.1 Flight Path Map

Global Positioning System

The GPS receiver takes in coded data from satellites in view and there after calculates the range to each satellite. The coded data must therefore include the instantaneous position of the satellite relative to some agreed earth-fixed coordinate system.

A further calculation using ranges to several satellites gives the position of the receiver in that coordinate system (eg. UTM, lat/long.). The elevation of the receiver is given with respect to a model ellipsoidal earth.

Normally the receiver must see four satellites for a full positional determination (three space coordinates and time). If the elevation is known in advance, only three satellites are needed. These are termed 3D and 2D solutions.

The position of the receiver is updated every tenth of a second. The accuracy of any one position determination is described by the Circular Error Probability (CEP). Ninety-five percent of all position determinations will fall within a circle of a certain radius. If the horizontal position accuracy is 25 m CEP, for example, 95% of all trials will fall within a circle of 25 m radius centred on the mean. The system may be degraded for civilian use and the autonomous accuracy is then 100 m CEP. This situation is called selective availability (SA). Much of this error (due principally to satellite position/time errors and atmospheric delays) can be removed using two GPS receivers operating simultaneously. One receiver acting as the base station, is at a known position. The second remote receiver is in the unknown position. Differential corrections determined for the base station may then be applied to the remote station. Differential positions are accurate to five m CEP (for a one second sample). Averaging will reduce this error further.

Flight Path

The flight path is drawn using linear interpolation between x,y positions from the navigation system. These positions are updated every second (or about 6.0 mm at a scale of 1:5,000). Occasional dropouts occur when the optimum number of satellites are not available for the GPS to make accurate positional determinations. Interpolation is used to cover short flight path gaps. The navigator's flight path and/or the flight path recovered from the video tape may be stitched in to cover larger gaps. Such gaps may be recognized by the distinct straight line character of the flight path.

The manual fiducials are shown as a small circle and labelled by fiducial number. The 24-hour clock time is shown as a small square, plotted every 30 seconds. Small tick marks are plotted every two seconds. Larger tick marks are plotted every 10 seconds. The line and flight numbers are given at the start and end of each survey line.

The aircraft position is expressed in geographic latitude and longitude coordinates, using the international WGS84 spheroid. Any particular survey area located on the globe has a specific reference ellipsoid or projection zone. A further refinement for a better fit to the earth's surface at the survey location is applied by adding or subtracting slight x, y and/or z datum shifts (a few metres to hundreds of metres) to the origin of the ellipsoid. The geographic coordinates are converted to fit this ellipsoid before calculating the UTM coordinates. The UTM coordinates are expressed as UTM eastings (x) and UTM northings (y).

The flight path map is merged with the base map by matching UTM coordinates from the base maps and the flight path record. The match is confirmed by checking the position of prominent topographic features as recorded by manual fiducial marks or as seen on the flight path video record.

5.2 Electromagnetic Survey Data

The electromagnetic data are recorded digitally at a sample rate of 10 per second with a time constant of 0.1 seconds. A two stage digital filtering process rejects major sferic events and reduces system noise. Local sferic activity can produce sharp, large amplitude events that cannot be removed by conventional filtering procedures. Smoothing or stacking will reduce their amplitude but leave a broader residual response that can be confused with geological phenomena. To avoid this possibility, a computer algorithm searches out and rejects the major sferic events. This is referred to as a "surgical mute" in signal processing terms. The signal to noise ratio is further enhanced by the application of a low pass digital filter. This filter has zero phase shift that prevents any lag or peak displacement from occurring, and it suppresses only variations with a wavelength less than about 0.25 seconds. This low effective time constant gives minimal profile distortion.

Following the filtering process, a base level correction is made using EM zero levels determined during high altitude calibration sequences. The correction applied is a linear function of time that ensures the corrected amplitude of the various inphase and quadrature components is zero when no conductive or permeable source is present. The filtered and levelled data are the basis for the determination of apparent resistivity (see following section). The inphase and quadrature responses along the flight line are presented in profile form offset along the flight lines.

5.3 Total Field Magnetics

The aeromagnetic data is corrected for diurnal variations by adjustment with the recorded base station magnetic values. No corrections for regional variations are applied. The corrected profile data are interpolated on to a regular grid using an Akima spline technique. The grid provided the basis for threading the presented contours. The minimum contour interval is 2 nT with a grid cell size of 10 m.

5.4 Calculated Vertical Magnetic Gradient

The vertical magnetic gradient is calculated from the gridded total field magnetic data. The calculation is based on a 17 x 17 point convolution in the space domain. The results are contoured using a minimum contour interval of 0.05 nT/m. Grid cell sizes are the same as those used in processing the total field data.

5.5 Apparent Resistivity

The apparent resistivity is calculated by assuming a 200 metre thick conductive layer over resistive bedrock. The computer determines the resistivity that would be consistent with the sensor elevation and recorded inphase and quadrature response amplitudes at the selected frequency. The apparent resistivity profile data is re-interpolated onto a regular grid at a 10 metres true scale interval using an Akima spline technique and contoured using logarithmically arranged contour intervals. The minimum contour interval depends on the selected frequency and is in units of log(ohm.m) in logarithmic intervals of 0.1, 0.5, 2.0, 5.0 etc.

The highest measurable resistivity is approximately equal to the transmitter frequency. The lower limit on apparent resistivity is rarely reached.

6. INTERPRETATION

6.1 Area Geology

The area is underlain by generally west-northwest striking intercalated intermediate to felsic metavolcanic rocks intruded by ultramafic rocks, later felsic intrusives as well as mafic dykes. Sulphide mineralization is ubiquitous to the area and occasionally contains nickel and copper mineralization. The nickel mineralization is associated with sulphides in ultramafic rocks and iron formation. The former nickel producing Redstone Mine, operated in the early 1990's by Timmins Nickel Inc., is just east of the eastern boundary of the southeast map sheet. The Timmins area is also well known for its many past producing and producing gold mines.

The author was involved with geophysical exploration on properties held by Timmins Nickel Inc. in Eldorado and Langmuir Township in 1991/92 and was involved with numerous other exploration programs covering the Timmins area since the Kidd Creek deposit was discovered in 1963/64.

6.2 Magnetic Interpretation

The total field magnetic responses reflect major changes in the magnetite content of the underlying rock units. The amplitude of the magnetic responses relative to the regional background help to assist in identifying specific magnetic and nonmagnetic units related to, for example, mafic flows or tuffs, mafic to ultramafic intrusives, felsic intrusives, felsic volcanics and/or sediments etc. Obviously, several geological sources can produce the same magnetic response. These ambiguities can be reduced considerably if basic geological information on the area is available to the geophysical interpreter.

In addition to amplitude variations, magnetic patterns related to the geometry of the particular rock unit also help in determining the probable source of the magnetic response. For instance, long narrow magnetic linears usually reflect mafic tuff/flow horizons or mafic intrusive dyke structures while semi-circular features with complex magnetic amplitudes may be produced by local plug-like intrusive sources such as pegmatites, carbonatites or kimberlites.

The calculated vertical magnetic gradient assists considerably in mapping weaker magnetic linears that are partially masked by nearby higher amplitude magnetic features. The broad zones of higher magnetic amplitude, however, are severely attenuated in the vertical magnetic gradient results. These higher amplitude zones reflect rock units having magnetic susceptibility signatures. For this reason both the total and gradient magnetic data sets must be evaluated.

Theoretically the magnetic gradient zero contour line marks the contacts or limits of large magnetic sources. This applies to wide sources, greater than 50 metres, having simple slab geometries and shallow depth.(See discussion in Appendix I) Thus the gradient map also aids in the more accurate delineation of contacts between differing magnetic rock units.

The dominate magnetic features in the survey block are high amplitude complex responses. They have amplitudes exceeding 2,000 nT above a background of 58,000 nt. The high amplitude anomalies map the ultramafic rocks present in the area. The gradient assymetry of the anomalies, steep north gradient and gentle south gradient, indicate the ultramafic rocks have a south dip direction.

6.3 Electromagnetic Anomaly Selection/Interpretation

Usually two sets of stacked colour coded profile maps of one coaxial and one coplanar inphase and quadrature responses are used to select conductive anomalies of interest. Selection of anomalies is based on conductivity as indicated by the inphase to quadrature ratios of the 2539 Hz coaxial data, anomaly shape, and anomaly profile characteristics relative to coaxial and corresponding coplanar responses.(see discussion and figure in Appendix I) It is difficult to differentiate between responses associated with the edge effects of flat lying conductors and actual poor conductivity bedrock conductors on the edge of or overlain by flat lying conductors. Poor conductivity bedrock conductors having low dips will also exhibit responses that may be interpreted as surficial overburden conductors. In such cases, where the source of the conductive response appears to be ambiguous, the anomaly is still selected for plotting. In some situations the conductive response has line to line continuity and some magnetic association thus providing possible evidence that the response is related to an actual bedrock source.

For this survey most of the electromagnetic anomaly intercepts selected for plotting are good conductivity responses. Conductive overburden areas show up as broad poor conductivity responses with usually only a quadrature response. The resistivity results show the presence of these poor conductivity areas as well as the higher conductivity anomalies related to bedrock features. The anomalies are sometimes dual responses and the conductive sources are near vertical to south dipping.

In some cases the inphase profile component exhibits a negative anomaly response usually over obvious magnetic areas. This is produced by local concentrations of magnetite and usually occurs when the sensor is flying close to the ground surface. If only magnetite is present there will be no quadrature response associated with the negative inphase response. If conductive material is present, however, such as graphite or sulphides, a positive quadrature response will be evident with the negative inphase response. In this case the anomaly is selected for plotting and evaluation and designated as a magnetic/conductive response. There are a few negative inphase responses on the southeast map sheet as well as a marked susceptibility effect on the east side of the northwest map sheet. On the latter sheet, there is no quadrature response and the negative inphase correlates directly with a local isolated bull's eye type magnetic anomaly.

The calculation of the depth to the conductive source and its conductivity is based on the 2539 Hz data assuming a thin vertical sheet model. The amplitude of the inphase and quadrature responses are used for the calculations which are automatically determined by computer. These data are listed in Appendix II and the depth and conductivity values are shown with each plotted anomaly. Further detailed discussion and illustration of the determination of these values is contained in Appendix I.

The selected anomalies are automatically categorized according to their conductivity and amplitude. The calculation of the conductivity of low amplitude anomalies can be very inaccurate. Therefore, anomalies having amplitudes below a certain level and/or low conductivity value are given a zero rating with the category increasing for increasing conductivity values that are statistically reliable.

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for

AERODAT INC.

J9625

*April 9, 1996

APPENDIX I

GENERAL INTERPRETIVE CONSIDERATIONS

GENERAL INTERPRETIVE CONSIDERATIONS

Electromagnetic

The Aerodat electromagnetic system utilized two different transmitter-receiver coil geometries. The traditional coaxial coil configuration is operated at widely separated frequencies. The horizontal coplanar coil configuration is similarly operated at different frequencies where at least one pair is approximately aligned with one of the coaxial frequencies.

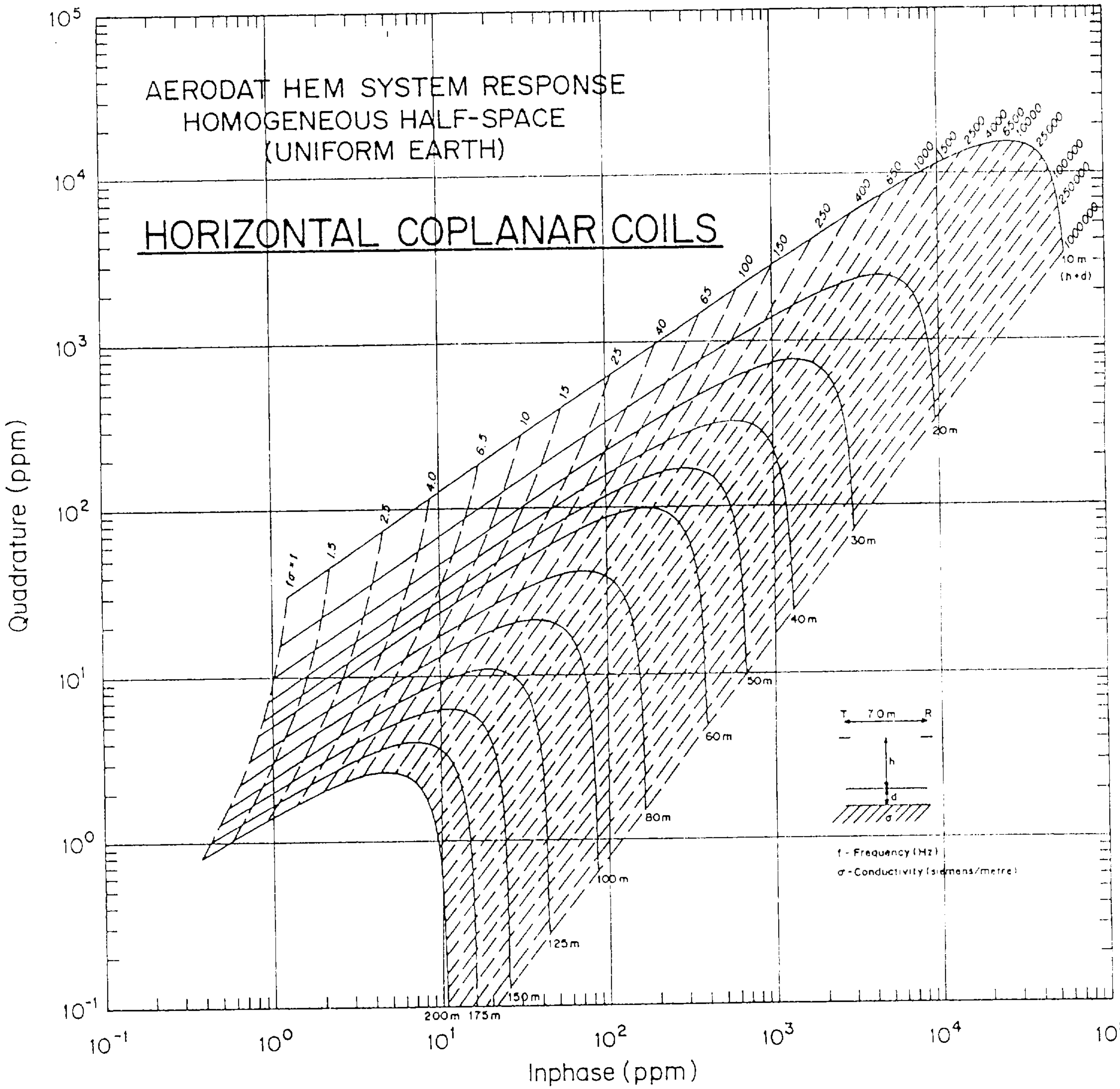
The electromagnetic response measured by the helicopter system is a function of the "electrical" and "geometrical" properties of the conductor. The "electrical" property of a conductor is determined largely by its electrical conductivity, magnetic susceptibility and its size and shape; the "geometrical" property of the response is largely a function of the conductor's shape and orientation with respect to the measuring transmitter and receiver.

Electrical Considerations

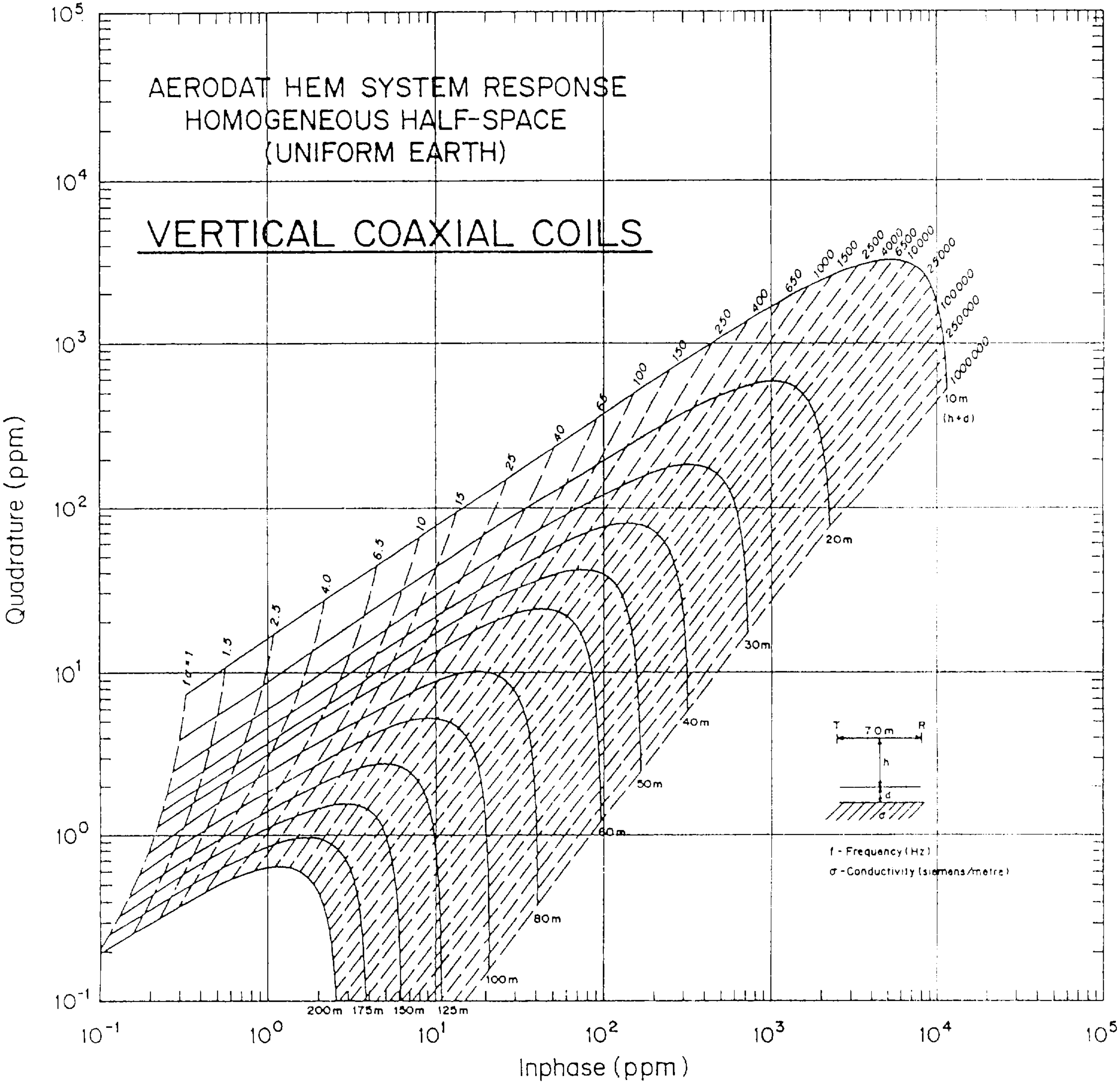
For a given conductive body the measure of its conductivity or conductance is closely related to the measured phase shift between the received and transmitted electromagnetic field. A small phase shift indicates a relatively high conductance, a large phase shift lower conductance. A small phase shift results in a large inphase to quadrature ratio and a large phase shift a low ratio. This relationship is shown quantitatively for a non-magnetic vertical half-plane and half space models on the accompanying phasor diagrams. Other physical models will show the same trend but different quantitative relationships.

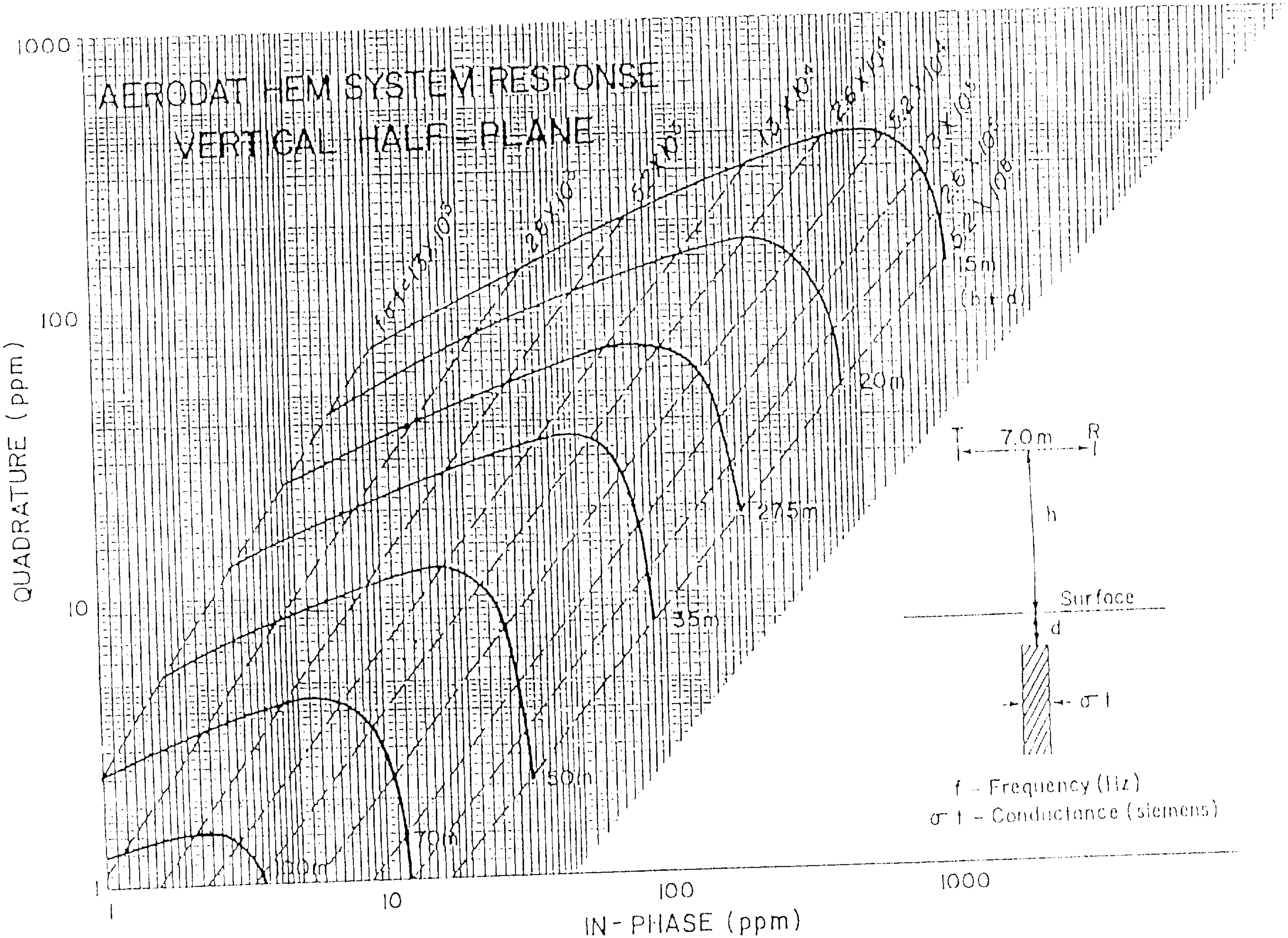
The phasor diagram for the vertical half-plane model, as presented, is for the coaxial coil configuration with the amplitudes in parts per million (ppm) of the primary field as measured at the response peak over the conductor. To assist the interpretation of the survey results the computer is used to identify the apparent conductance and depth at selected anomalies. The results of this calculation are presented in anomaly listings included in the survey report and the conductance and inphase amplitude are presented in symbolized form on the map presentation.

The conductance estimate is most reliable when anomaly amplitudes are large and background resistivities are high. Where the anomaly is of low amplitude and background resistivities are low, the conductance estimates are much less reliable. In such situations, the conductance estimate is often quite low regardless of the true nature of the conductor. This is due to the elevated background response levels in the quadrature channel. In an extreme case, the conductance estimate should be discounted and should not prejudice target selection.



AERODAT HEM SYSTEM RESPONSE
HOMOGENEOUS HALF-SPACE
(UNIFORM EARTH)
HORIZONTAL COPLANAR COILS
Quadrature (ppm)
Inphase (ppm)
10 m (h+d)
20 m
30 m
40 m
50 m
60 m
80 m
100 m
125 m
150 m
175 m
200 m
T 7.0 m R
h
d
σ
f - Frequency (Hz)
σ - Conductivity (siemens/metre)


AERODAT HEM SYSTEM RESPONSE
HOMOGENEOUS HALF-SPACE
(UNIFORM EARTH)
VERTICAL COAXIAL COILS
Quadrature (ppm)
Inphase (ppm)
10^{-1}
10^{0}
10^{1}
10^{2}
10^{3}
10^{4}
10^{5}
10m
(h+d)
20m
30m
40m
50m
60m
80m
100m
200m 175m 150m 125m
T 70m R
h
d
f - Frequency (Hz)
σ - Conductivity (siemens/metre)



AERODAT HEM SYSTEM RESPONSE
VERTICAL HALF-PLANE
QUADRATURE (ppm)
IN-PHASE (ppm)
1000
100
10
1
15m
(h+d)
20m
27.5m
35m
50m
70m
T
7.0m
R
h
Surface
d
σ t
f - Frequency (Hz)
σ t - Conductance (siemens)

The conductance and depth vales as presented are correct only as far as the model approximates the real geological situation. The actual geological source may be of limited length, have significant dip, may be strongly magnetic. Its conductivity and thickness may vary with depth and/or strike and adjacent bodies and overburden may have modified the response. In general the conductance estimate is less affected by these limitations than is the depth estimate, but both should be considered as relative rather than absolute guides to the anomaly's properties.

Conductance in mhos is the reciprocal of resistance in ohms and in the case of narrow slab-like bodies is the product of electrical conductivity and thickness.

The higher ranges of conductance, greater than 2-4 mhos, indicate that a significant fraction of the electrical conduction is electronic rather than electrolytic in nature. Materials that conduct electronically are limited to certain metallic sulphides and to graphite. High conductance anomalies, roughly 10 mhos or greater, are generally limited to massive sulphides or graphites.

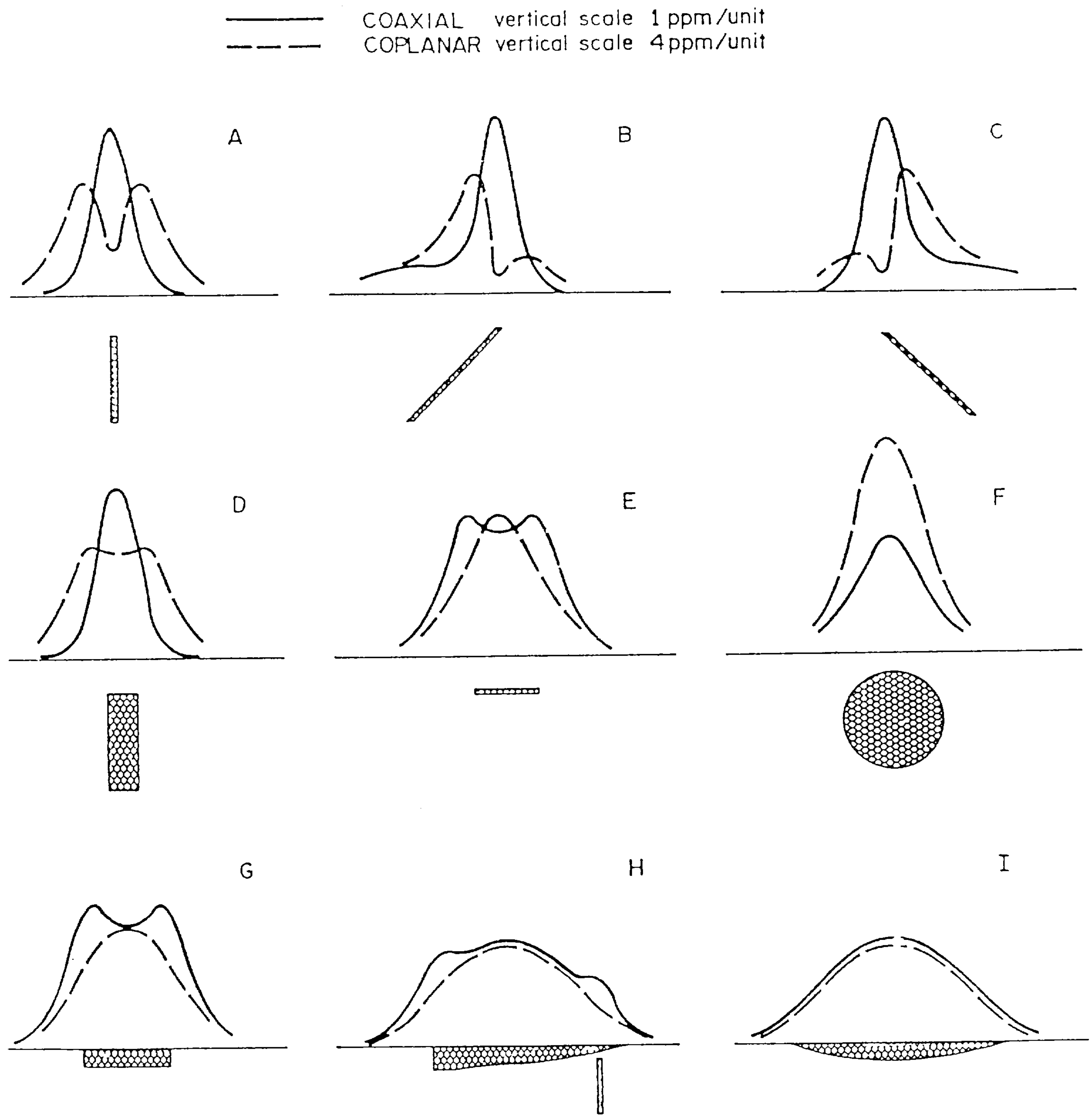
Sulphide minerals, with the exception of such ore minerals as sphalerite, cinnabar and stibnite, are good conductors. Sulphides may occur in a disseminated manner that inhibits electrical conduction through the rock mass. In this case the apparent conductance can seriously underrate the quality of the conductor in geological terms. In a similar sense the relatively non-conducting sulphide minerals noted above may be present in significant concentrations in association with minor conductive sulphides, and the electromagnetic response will only relate to the minor associated mineralization. Indicated conductance is also of little direct significance for the identification of gold mineralization. Although gold is highly conductive, it would not be expected to exist in sufficient quantity to create a recognizable anomaly. Minor accessory sulphide mineralization may however provide a useful indirect indication.

In summary, the estimated conductance of a conductor can provide a relatively positive identification of significant sulphide or graphite mineralization. A moderate to low conductance value does not rule out the possibility of significant economic mineralization.

Geometrical Considerations

Geometrical information about the geologic conductor can often be interpreted from the profile shape of the anomaly. The change in shape is primarily related to the change in inductive coupling among the transmitter, the target, and the receiver. The accompanying figure shows a selection of HEM response profile shapes from nine idealized targets. Response profiles are labelled A through I. These labels are used in the discussion which follows.

HEM RESPONSE PROFILE SHAPE AS AN INDICATOR OF CONDUCTOR GEOMETRY



In the case of a thin, steeply dipping, sheet-like conductor, the coaxial coil pair will yield a near symmetric peak over the conductor. On the other hand, the coplanar coil pair will pass through a null couple relationship and yield a minimum over the conductor, flanked by positive side lobes (Profile A). As the dip of the conductor decrease from vertical, the coaxial anomaly shape changes only slightly, but in the case of the coplanar coil pair the side lobe on the down dip side strengthens relative to that on the up dip side (Profiles B and C).

As the thickness of the conductor increases, induced current flow across the thickness of the conductor becomes relatively significant and complete null coupling with the coplanar coils is no longer possible (Profile D). As a result, the apparent minimum of the coplanar response over the conductor diminishes with increasing thickness, and in the limiting case of a fully 3 dimensional body or a horizontal layer or half-space, the minimum disappears completely.

A horizontal conducting layer such as a horizontal thin sheet or overburden will produce a response in the coaxial and coplanar coils that is a function of altitude (and conductivity if not uniform). The profile shape will be similar in both coil configurations with an amplitude ratio (coplanar:coaxial) of about 4:1* (Profiles E and G).

In the case of a spherical conductor, the induced currents are confined to the volume of the sphere, but not relatively restricted to any arbitrary plane as in the case of a sheet-like form. The response of the coplanar coil pair directly over the sphere may be up to 8* times greater than that of the coaxial pair (Profile F).

In summary, a steeply dipping, sheet-like conductor will display a decrease in the coplanar response coincident with the peak of the coaxial response. The relative strength of this coplanar null is related inversely to the thickness of the conductor. A pronounced null indicates a relatively thin conductor. The dip of such a conductor can be inferred from the relative amplitudes of the side-lobes.

Massive conductors that could be approximated by a conducting sphere will display a simple single peak profile form on both coaxial and coplanar coils, with a ratio between the coplanar to coaxial response amplitudes as high as 8*.

Overburden anomalies often produce broad poorly defined anomaly profiles (Profile I). In most cases, the response of the coplanar coils closely follows that of the coaxial coils with a relative amplitude ration of 4*.

Occasionally, if the edge of an overburden zone is sharply defined with some significant depth extent, an edge effect will occur in the coaxial coils. In the case of a horizontal conductive ring or ribbon, the coaxial response will consist of two peaks, one over each edge; whereas the coplanar coil will yield a single peak (Profile H).

* It should be noted at this point that Aerodat's definition of the measured ppm unit is related to the primary field sensed in the receiving coil without normalization to the maximum coupled (coaxial configuration). If such normalization were applied to the Aerodat units, the amplitude of the coplanar coil pair would be halved.

Magnetics

The Total Field Magnetic Map shows contours of the total magnetic field, uncorrected for regional variation. Whether an EM anomaly with a magnetic correlation is more likely to be caused by a sulphide deposit than one without depends on the type of mineralization. An apparent coincidence between an EM and a magnetic anomaly may be caused by a conductor which is also magnetic, or by a conductor which lies in close proximity to a magnetic body. The majority of conductors which are also magnetic are sulphides containing pyrrhotite and/or magnetite. Conductive and magnetic bodies in close association can be, and often are, graphite and magnetite. It is often very difficult to distinguish between these cases. If the conductor is also magnetic, it will usually produce an EM anomaly whose general pattern resembles that of the magnetics. Depending on the magnetic permeability of the conducting body, the amplitude of the inphase EM anomaly will be weakened, and if the conductivity is also weak, the inphase EM anomaly may even be reversed in sign.

The interpretation of contoured aeromagnetic data is a subject on its own involving an array of methods and attitudes. The interpretation of source characteristics for example from total field results is often based on some numerical modelling scheme. The vertical gradient data is more legible in some aspects however and useful inferences about source characteristics can often be read off the contoured VG map.

The zero contour lines in contoured VG data are often sited as a good approximation to the outline of the top of the magnetic source. This only applies to wide (relative to depth of burial) near vertical sources at high magnetic latitudes. It will give an incorrect interpretation in most other cases.

Theoretical profiles of total field and vertical gradient anomalies from tabular sources at a variety of magnetic inclinations are shown in the attached figure. Sources are 10, 50 and 200 m wide. The source-sensor separation is 50 m. The thin line is the total field profile. The thick line is the vertical gradient profile.

The following comments about source geometry apply to contoured vertical gradient data for magnetic inclinations of 70 to 80°.

Outline

Where the VG anomaly has a single sharp peak, the source may be a thin near-vertical tabular source. It may be represented as a magnetic axis or as a tabular source of measurable width - the choice is one of geological preference.

Where the VG anomaly has a broad, flat or inclined top, the source may be a thick tabular source. It may be represented as a thick body where the width is taken from the zero contour lines if the body dips to magnetic north. If the source appears to be dipping to the south (i.e. the VG anomaly is asymmetric), the zero contours are less reliable indicators of outline. The southern most zero contour line should be ignored and the outline taken from the northern zero contour line and the extent of the anomaly peak width.

Dip

A symmetrical vertical gradient response is produced by a body dipping to magnetic north. An asymmetrical response is produced by a body which is vertical or dipping to the south. For southern dips, the southern most zero contour line may be several hundred meters south of the source.

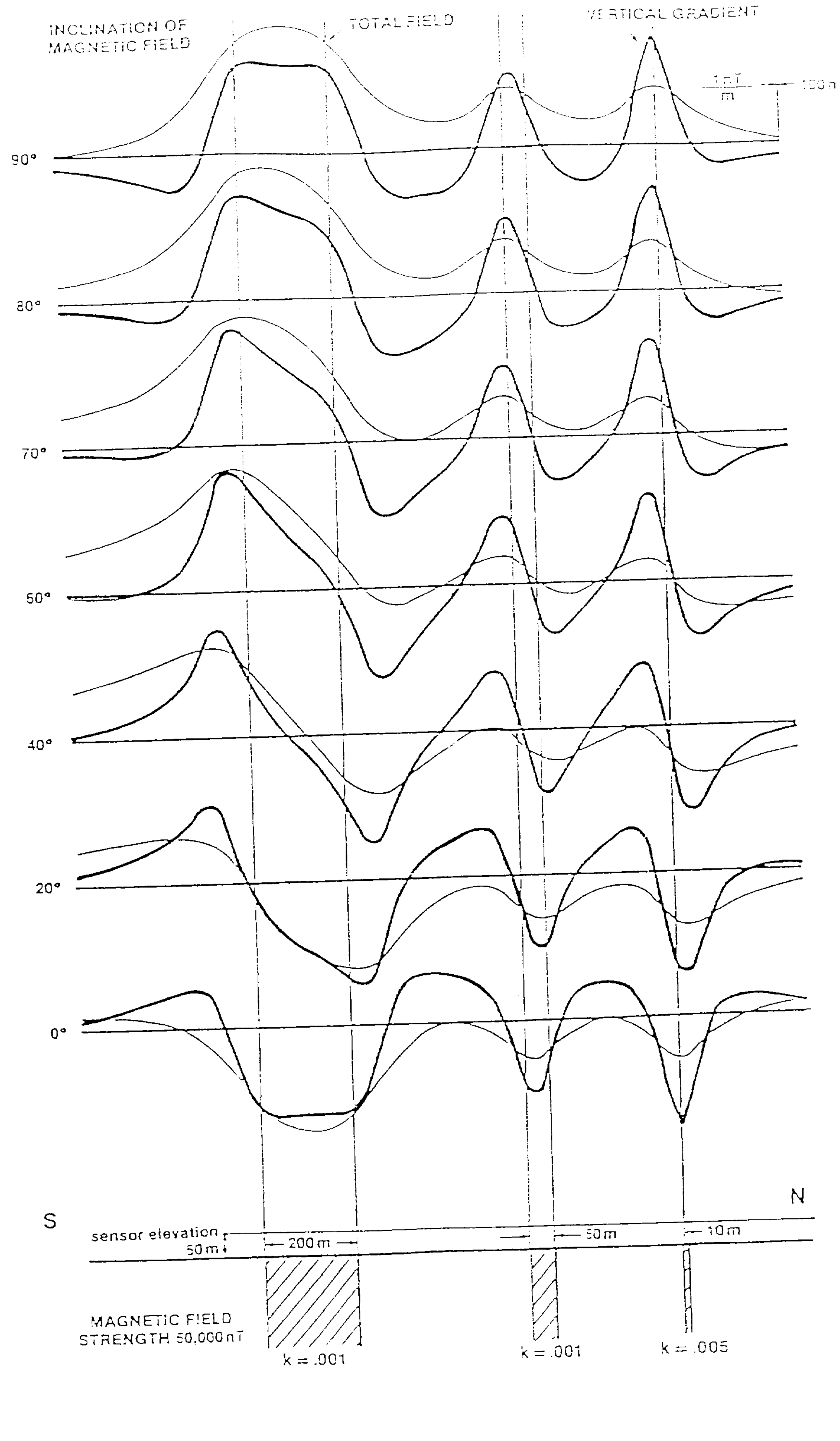
Depth of Burial

The source-sensor separation is about equal to half of the distance between the zero contour lines for thin near-vertical sources. The estimated depth of burial for such sources is this separation minus 50 m. If a variety of VG anomaly widths are seen in an area, use the narrowest width seen to estimate local depths.

VLF Electromagnetics

The VLF-EM method employs the radiation from powerful military radio transmitters as the primary signals. The magnetic field associated with the primary field is locally horizontal and normal to a line pointing at the transmitter.

The Herz Totem uses three coils in the X, Y, Z configuration to measure the total field and vertical quadrature component from two VLF stations. These stations are designated Line and Ortho. The line station is ideally in a direction from the survey area at right angles to the flight line direction. Conductors normal to the flight line direction point at the line station and are therefore optimally coupled to VLF magnetic fields and in the best situation to gather secondary VLF currents. The ortho station is ideally 90 degrees in azimuth from the line station.



INCLINATION OF MAGNETIC FIELD
TOTAL FIELD
VERTICAL GRADIENT
1 nT/m
100 nT
90°
80°
70°
60°
40°
20°
0°
S
N
sensor elevation 50 m
200 m
50 m
10 m
MAGNETIC FIELD STRENGTH 50,000 nT
k = .001
k = .001
k = .005

The relatively high frequency of VLF (15-25) kHz provides high response factors for bodies of low conductance. Relatively "disconnected" sulphide ores have been found to produce measurable VLF signals. For the same reason, poor conductors such as sheared contacts, breccia zones, narrow faults, alteration zones and porous flow tops normally produce VLF anomalies. The method can therefore be used effectively for geological mapping. The only relative disadvantage of the method lies in its sensitivity to conductive overburden. In conductive ground to depth of exploration is severely limited.

The effect of strike direction is important in the sense of the relation of the conductor axis relative to the energizing electromagnetic field. A conductor aligned along a radius drawn from a transmitting station will be in a maximum coupled orientation and thereby produce a stronger response than a similar conductor at a different strike angle. Theoretically, it would be possible for a conductor, oriented tangentially to the transmitter to produce no signal. The most obvious effect of the strike angle consideration is that conductors favourably oriented with respect to the transmitter location and also near perpendicular to the flight direction are most clearly rendered and usually dominate the map presentation.

The total field anomaly is an indicator of the existence and position of a conductor. The response will be a maximum over the conductor, without any special filtering, and strongly favour the upper edge of the conductor even in the case of a relatively shallow dip.

Conversely a negative total field anomaly is often seen over local resistivity highs. This is because the VLF field produces electrical currents which flow towards (or away from) the transmitter. These currents are gathered into a conductor and are taken from resistive bodies. The VLF system sees the currents gathered into the conductor as a total field high. It sees the relative absence of secondary currents in the resistor as a total field low.

As noted, VLF anomaly trends show a strong bias towards the VLF transmitter. Structure which is normal to this direction may have no associated VLF anomaly but may be seen as a break or interruption in VLF anomalies. If these structures are of particular interest, maps of the ortho station data may be worthwhile.

Conductive overburden will obscure VLF responses from bedrock sources and may produce low amplitude, broad anomalies which reflect variations in the resistivity of thickness of the overburden.

Extreme topographic relief will produce VLF anomalies which may bear no relationship to variations in electrical conductivity. Deep gullies which are too narrow to have been surveyed at a uniform sensor height often show up as VLF total field lows. Sharp ridges show up as total field highs.

The vertical quadrature component over steeply dipping sheet-like conductor will be a cross-over type response with the cross-over closely associated with the upper edge of the conductor.

The response is a cross-over type due to the fact that it is the vertical rather than total field quadrature component that is measured. The response shape is due largely to geometrical rather than conductivity considerations and the distance between the maximum and minimum on either side of the cross-over is related to target depth. For a given target geometry, the larger this distance the greater the depth.

The vertical quadrature component is rarely presented. Experience has shown the total field to be more sensitive to bedrock conductors and less affected by variations in conductive overburden.

Apparent Resistivity/Conductivity Maps

Overburden and different types of bedrock may be modelled as a large area horizontal conductor of fixed thickness. A phasor diagram may be constructed, in the same fashion as for the vertical sheet, to convert the measured HEM in-phase and quadrature response to a depth and conductivity value for a horizontal layer. Traditionally if the thickness is large, an infinite half-space, the associated conductivity value is referred to as "apparent conductivity". We have generalized the use of the word "apparent" to include any model where the thickness of the layer is a fixed as opposed to a variable parameter. The units of apparent resisitivity are ohm-m and those of apparent conductivity are the inverse mhos/m or siemen/m. If the chosen model layer thickness is close to the true thickness of the conductor then the apparent conductivity will closely conform to the true value; however, if the thickness is inappropriate the apparent value may be considerably different from the true value.

The benefit of the apparent conductivity mapping is that it provides a simple robust method of converting the HEM in-phase and quadrature response to apparent change in ground conductivity.

A phasor diagram for several apparent resistivity models is presented. The general forms for the various thicknesses is very similar and also closely resembles the diagram for the vertical sheet. The diagrams also show the curves for apparent depth. As with the conductivity value the depth value is meaningful if the model thickness closely resembles the true conductive layer thickness. If the HEM response from a thin conducting layer is applied to a thick layer model the apparent conductivity and depth will be less than the true conductivity and depth.

APPENDIX II

ANOMALY LISTINGS

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

				AMPLITUDE (PPM)		CONDUCTOR CTP	DEPTH	BIRD HEIGHT		
FLIGHT	LINE	ANOMALY	CATEGORY	INPHASE	QUAD.	MHOS	MTRS	MTRS		
1	10220	A	0	10.2	12.7	0.7	9	37	483062.1	5354723.0
2	10221	A	0	6.0	13.7	0.2	6	33	483043.3	5354715.5
2	10230	A	1	14.0	14.3	1.1	12	34	483083.7	5354721.5
2	10240	C	0	9.9	12.1	0.7	12	35	483138.5	5354717.5
2	10240	D	0	9.9	12.4	0.7	12	35	483136.7	5354711.5
2	10250	A	0	5.3	8.6	0.3	18	32	483194.5	5354686.5
2	10260	C	0	3.6	5.3	0.3	29	33	483236.2	5354693.5
2	10260	D	0	3.3	5.0	0.3	29	33	483234.3	5354687.5
2	10270	A	3	17.5	6.4	4.8	17	39	483316.7	5354722.0
2	10270	B	3	17.5	6.4	4.8	16	39	483319.0	5354729.0
2	10280	C	4	56.9	16.6	9.2	6	32	483376.0	5354710.5
2	10280	D	4	51.3	15.7	8.4	7	32	483374.1	5354704.5
2	10290	A	4	32.1	7.7	10.1	7	40	483409.9	5354706.0
2	10300	C	3	79.7	28.2	7.9	0	34	483477.3	5354742.5
2	10300	D	3	55.8	20.4	6.8	4	33	483457.4	5354682.0
2	10300	E	3	51.0	19.5	6.3	4	34	483455.4	5354676.0
2	10310	A	3	21.8	9.0	4.3	14	37	483481.6	5354653.5
2	10310	B	3	54.8	19.1	7.2	1	37	483503.1	5354731.0
2	10320	A	1	13.2	12.9	1.1	13	34	483615.4	5354780.0
2	10320	B	2	35.1	18.0	3.8	7	35	483593.0	5354714.0
2	10320	C	2	33.4	17.1	3.7	7	35	483591.1	5354709.0
2	10330	A	2	20.2	10.8	3.0	12	38	483623.8	5354735.0
2	10330	B	2	18.8	11.1	2.5	12	38	483635.7	5354769.0
2	10340	A	0	4.0	9.1	0.2	12	33	483703.5	5354747.0
2	10560	A	0	8.7	12.6	0.5	10	35	484318.6	5353146.5
2	10570	A	1	16.1	15.5	1.2	9	36	484357.5	5353127.0
2	10580	A	0	11.0	17.3	0.5	8	32	484401.3	5353095.5
2	10660	A	0	3.7	6.8	0.2	23	31	484845.2	5352959.0

Estimated depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or overburden effects.

ADAMS,DELORO,ELDORADO,LANGMUIR,CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

				AMPLITUDE (PPM)		CONDUCTOR		BIRD		
						CTP	DEPTH	HEIGHT		
FLIGHT	LINE	ANOMALY	CATEGORY	INPHASE	QUAD.	MHOS	MTRS	MTRS		
2	10670	A	0	3.4	4.9	0.3	28	35	484858.2	5352939.5
1	10010	A	2	19.5	10.3	3.0	18	33	482394.9	5356290.5
1	10010	B	3	41.8	16.7	5.6	8	33	482357.9	5356168.5
1	10010	C	1	10.9	10.3	1.1	14	38	482240.0	5355763.5
1	10020	A	2	19.2	12.5	2.2	7	42	482300.8	5355733.5
1	10020	B	3	24.5	9.3	5.0	9	40	482421.3	5356151.5
1	10020	C	3	24.8	10.2	4.5	8	40	482448.6	5356239.0
1	10030	A	3	43.3	16.5	6.0	10	30	482477.9	5356201.5
1	10030	B	3	33.2	14.8	4.5	9	34	482458.7	5356138.5
1	10030	C	1	17.3	14.3	1.6	6	40	482325.5	5355734.0
1	10041	A	2	16.7	11.6	2.0	10	40	482356.5	5355715.5
1	10041	B	4	34.4	7.7	11.3	4	42	482511.8	5356200.0
1	10050	A	3	32.2	10.9	6.4	8	38	482545.7	5356193.0
1	10050	B	0	3.0	5.3	0.2	22	37	482440.0	5355807.5
1	10050	C	1	11.9	12.0	1.0	12	37	482403.9	5355675.0
1	10060	A	2	10.5	5.5	2.4	21	42	482487.3	5355618.5
1	10060	B	4	23.8	4.1	14.5	13	40	482616.4	5356117.0
1	10060	C	3	36.7	11.4	7.5	4	40	482638.5	5356194.0
1	10070	A	4	43.5	12.1	9.1	8	34	482680.5	5356161.0
1	10070	B	4	52.5	13.5	10.6	3	36	482664.5	5356089.5
1	10070	C	4	32.5	6.7	12.4	12	35	482647.8	5356020.0
1	10070	D	6	15.9	0.8	69.0	27	36	482623.6	5355959.0
1	10070	E	1	7.9	6.0	1.3	24	39	482504.0	5355575.5
1	10080	A	1	6.9	6.1	1.0	23	39	482566.3	5355535.5
1	10080	B	4	34.8	7.2	12.6	10	36	482701.0	5356002.0
1	10080	C	3	37.6	12.5	6.9	5	38	482730.3	5356096.0
1	10091	A	2	24.8	15.3	2.6	11	34	482771.4	5356092.5
1	10091	B	2	16.6	7.7	3.4	22	33	482744.4	5355982.5
1	10091	C	0	6.0	12.7	0.2	9	32	482596.6	5355512.5
1	10100	A	0	4.5	11.0	0.2	2	40	482669.4	5355481.5
1	10100	B	1	6.5	4.3	1.5	31	39	482759.3	5355812.0
1	10100	C	2	19.8	8.9	3.7	13	39	482809.6	5355966.0
1	10100	D	2	19.2	12.0	2.4	10	39	482829.9	5356024.5
1	10110	A	1	19.4	15.6	1.7	9	36	482845.3	5355996.0

Estimated depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or overburden effects.

ADAMS,DELORO,ELDORADO,LANGMUIR,CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

				AMPLITUDE (PPM)		CONDUCTOR CTP	DEPTH	BIRD HEIGHT		
FLIGHT	LINE	ANOMALY	CATEGORY	INPHASE	QUAD.	MHOS	MTRS	MTRS		
1	10110	B	2	22.5	13.6	2.6	12	35	482823.1	5355910.5
1	10110	C	1	7.6	6.7	1.0	25	36	482778.4	5355776.5
1	10110	D	0	5.4	14.9	0.1	1	36	482693.1	5355471.0
1	10120	A	0	5.0	11.9	0.2	0	41	482740.3	5355466.0
1	10120	B	1	9.2	7.5	1.2	20	38	482824.7	5355773.5
1	10120	C	2	19.6	12.2	2.4	12	37	482855.2	5355887.5
1	10120	D	2	26.8	19.8	2.1	5	37	482882.1	5355978.5
1	10130	A	2	30.8	20.3	2.6	7	34	482917.7	5355863.0
1	10130	B	1	10.0	7.6	1.4	23	35	482878.4	5355732.5
1	10140	A	2	15.3	10.3	2.0	15	37	482915.1	5355688.5
1	10140	B	2	25.2	14.2	3.0	9	37	482958.2	5355812.5
1	10150	A	1	18.1	13.7	1.8	12	36	482989.8	5355779.5
1	10150	B	2	17.0	11.7	2.0	11	38	482954.6	5355669.0
1	10160	A	0	9.4	11.5	0.7	12	36	482996.1	5355631.5
1	10160	B	1	13.3	14.4	1.0	7	38	483025.8	5355721.0
1	10170	A	0	8.2	12.4	0.5	9	36	483059.3	5355715.0
1	10170	B	0	6.7	10.2	0.4	13	35	483037.5	5355637.5
1	10181	A	0	5.2	6.0	0.6	25	37	483041.4	5355361.0
1	10210	A	1	13.0	11.5	1.3	15	35	483121.5	5355071.0
1	10210	B	0	9.8	11.8	0.7	12	36	483100.9	5355012.0
1	10220	A	0	10.2	12.7	0.7	9	37	483062.1	5354723.0
1	10220	B	0	9.6	13.7	0.6	8	37	483154.7	5355002.5
1	10220	C	1	17.8	13.4	1.8	10	37	483175.3	5355058.5
2	10221	A	0	6.0	13.7	0.2	6	33	483043.3	5354715.5
2	10230	A	1	14.0	14.3	1.1	12	34	483083.7	5354721.5
2	10230	B	0	12.0	14.6	0.8	9	35	483174.4	5354996.5
2	10230	C	2	25.6	15.7	2.7	8	36	483192.3	5355052.5
2	10240	A	0	12.1	13.0	0.9	12	35	483229.9	5355017.0
2	10240	B	0	4.5	4.8	0.6	33	34	483206.1	5354938.5
2	10240	C	0	9.9	12.1	0.7	12	35	483138.5	5354717.5
2	10240	D	0	9.9	12.4	0.7	12	35	483136.7	5354711.5
2	10250	A	0	5.3	8.6	0.3	18	32	483194.5	5354686.5

Estimated depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or overburden effects.

ADAMS,DELORO,ELDORADO,LANGMUIR,CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

				AMPLITUDE (PPM)		CONDUCTOR		BIRD		
						CTP	DEPTH	HEIGHT		
FLIGHT	LINE	ANOMALY	CATEGORY	INPHASE	QUAD.	MHOS	MTRS	MTRS		
2	10250	B	1	5.2	2.7	1.9	46	35	483265.3	5354905.5
2	10260	A	1	6.8	4.9	1.3	34	34	483306.0	5354910.5
2	10260	B	1	8.8	5.4	1.8	31	33	483295.1	5354881.5
2	10260	C	0	3.6	5.3	0.3	29	33	483236.2	5354693.5
2	10260	D	0	3.3	5.0	0.3	29	33	483234.3	5354687.5
2	10270	A	3	17.5	6.4	4.8	17	39	483316.7	5354722.0
2	10270	B	3	17.5	6.4	4.8	16	39	483319.0	5354729.0
2	10270	C	3	16.4	5.1	5.8	18	40	483345.0	5354811.5
2	10270	D	4	22.5	5.9	8.1	13	39	483360.1	5354859.5
2	10280	A	4	43.1	12.1	8.9	9	33	483413.8	5354841.5
2	10280	B	3	40.2	16.3	5.4	8	33	483395.6	5354783.5
2	10280	C	4	56.9	16.6	9.2	6	32	483376.0	5354710.5
2	10280	D	4	51.3	15.7	8.4	7	32	483374.1	5354704.5
2	10290	A	4	32.1	7.7	10.1	7	40	483409.9	5354706.0
2	10290	B	3	38.0	11.9	7.5	4	39	483431.3	5354768.0
2	10290	C	4	50.6	11.1	13.0	2	38	483452.7	5354831.0
2	10300	A	4	47.5	14.2	8.5	6	35	483515.2	5354857.0
2	10300	B	4	69.8	21.8	9.0	1	34	483501.1	5354815.5
2	10300	C	3	79.7	28.2	7.9	0	34	483477.3	5354742.5
2	10300	D	3	55.8	20.4	6.8	4	33	483457.4	5354682.0
2	10300	E	3	51.0	19.5	6.3	4	34	483455.4	5354676.0
2	10310	A	3	21.8	9.0	4.3	14	37	483481.6	5354653.5
2	10310	B	3	54.8	19.1	7.2	1	37	483503.1	5354731.0
2	10310	C	4	65.2	16.8	11.3	0	38	483527.3	5354823.0
2	10320	A	1	13.2	12.9	1.1	13	34	483615.4	5354780.0
2	10320	B	2	35.1	18.0	3.8	7	35	483593.0	5354714.0
2	10320	C	2	33.4	17.1	3.7	7	35	483591.1	5354709.0
2	10330	A	2	20.2	10.8	3.0	12	38	483623.8	5354735.0
2	10330	B	2	18.8	11.1	2.5	12	38	483635.7	5354769.0
2	10340	A	0	4.0	9.1	0.2	12	33	483703.5	5354747.0
2	10800	A	3	30.6	11.8	5.3	14	31	485399.3	5352433.5
2	10800	B	3	26.4	10.1	5.1	15	33	485415.8	5352503.5
2	10800	C	0	4.2	9.4	0.2	13	33	485468.7	5352683.0
2	10810	A	1	8.4	5.0	1.9	34	32	485462.7	5352450.0

Estimated depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or overburden effects.

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

				AMPLITUDE (PPM)		CONDUCTOR CTP	CONDUCTOR DEPTH	BIRD HEIGHT		
FLIGHT	LINE	ANOMALY	CATEGORY	INPHASE	QUAD.	MHOS	MTRS	MTRS		
2	10810	B	3	13.4	5.2	4.0	28	32	485445.9	5352404.5
2	10820	A	2	27.4	14.4	3.4	9	36	485430.4	5352199.5
2	10840	A	2	22.8	16.1	2.1	9	36	485472.3	5352154.0

Estimated depth may be unreliable because the stronger part of the conductor may be deeper or to one side of the flight line, or because of a shallow dip or overburden effects.

APPENDIX III

PERSONNEL

FIELD

Flown	March 27 and 28, 1996
Pilot(s)	Roger Morrow
Operator(s)	G. Lipa

OFFICE

Processing	Marie Logotheti George McDonald
Report	R. W. Woolham

APPENDIX IV

CERTIFICATE OF QUALIFICATION

I, Roderick W. Woolham of the town of Pickering, Province of Ontario, do hereby certify that:-

1. I am a geophysicist and reside at 1463 Fieldlight Blvd., Pickering, Ontario, L1V 2S3

2. I graduated from the University of Toronto in 1961 with a degree of Bachelor of Applied Science, Engineering Physics, Geophysics Option. I have been practising my profession since graduation.

3. I am a member in good standing of the following organizations: Professional Engineers Ontario (Mining Branch); Society of Exploration Geophysicists; South African Geophysical Association; Prospectors and Developers Association of Canada.

4. I have not received, nor do I expect to receive, any interest, directly or indirectly, in the properties or securities of Outokumpu Mines Limited or any affiliate.

5. The statements contained in this report and the conclusions reached are based upon evaluation and review of maps and information supplied by Aerodat.

6. I consent to the use of this report in submissions for assessment credits or similar regulatory requirements.

R. W. Woolham, P.Eng.

Pickering, Ontario

*April 9, 199622

REPORT

ON A
COMBINED HELICOPTER-BORNE
ELECTROMAGNETIC AND MAGNETIC SURVEY

ADAMS AND ELDORADO TOWNSHIPS
TIMMINS AREA
PROVINCE OF ONTARIO
NTS 42 A/6

FOR

OUTOKUMPU MINES LIMITED
P.O. BOX 1123
TIMMINS, ONTARIO
CANADA P4N 7H9

BY

2.16592

AERODAT INC.
3883 NASHUA DRIVE
MISSISSAUGA, ONTARIO
CANADA L4V 1R3
PHONE: 905-671-2446

*April 9, 1996

J9625

R. W. Woolham, P. Eng.
Consulting Geophysicist

PART (2) of (2)

Ministry of Northern Development and Mines
Ontario

Report of Work Conducted After Recording Claim

Mining Act

Transaction Number W9660.00267

Personal information collected on this form is obtained under the authority of the Mining Act. This information will be used for correspondence. Questions about this collection should be directed to the Provincial Manager, Mining Lands, Ministry of Northern Development and Mines, Fourth Floor, 159 Cedar Street, Sudbury, Ontario, P3E 6A5, telephone (705) 670-7264.

Instructions:
- Please type or print and submit in duplic
- Refer to the Mining Act and Regulations ... ng Recorder.
- A separate copy of this form must be co
- Technical reports and maps must accom
- A sketch, showing the claims the work is

42A06SE0082 2.16592 ELDORADO

900

Recorded Holder(s): Outokumpu Mines Ltd.		Client No.: 178525
Address: P.O. Box 1123, Timmins, Ontario, P4N 7H9		Telephone No.: (705) 264-5024
Mining Division: Porcupine	Township/Area: Adams, Eldorado Townships	M or G Plan No.: G-3925, G-4001
Dates Work Performed From: March 28-96	To: March 29-96.	

Work Performed (Check One Work Group Only)

	Work Group	Type
	Geotechnical Survey	Airborne Mag and EM (Helicopter survey)
	Physical Work, Including Drilling	
	Rehabilitation	
	Other Authorized Work	2.16592
	Assays	
	Assignment from Reserve	

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Total Assessment Work Claimed on the Attached Statement of Costs $ 20,907

Note: The Minister may reject for assessment work credit all or part of the assessment work submitted if the recorded holder cannot verify expenditures claimed in the statement of costs within 30 days of a request for verification.

Persons and Survey Company Who Performed the Work (Give Name and Address of Author of Report)

Name	Address
Aerodat Inc.	
Report by R.W. Woolham	3883 Nashua Drive, Mississauga, Ont L4V 1R3

(attach a schedule if necessary)

Certification of Beneficial Interest * See Note No. 1 on reverse side

	Date	Recorded Holder or Agent (Signature)
I certify that at the time the work was performed, the claims covered in this work report were recorded in the current holder's name or held under a beneficial interest by the current recorded holder.	April 15-96	[signature]

Certification of Work Report

I certify that I have a personal knowledge of the facts set forth in this Work report, having performed the work or witnessed same during and/or after its completion and annexed report is true.

Name and Address of Person Certifying: Jarmo Vesanto P.O. Box 1123 Timmins Ont P4N 7H9

Telepone No.	Date	Certified By (Signature)
(705) 264-5024	April 15-96.	[signature]

For Office Use Only

Total Value Cr. Recorded	Date Recorded	Mining Recorder	Received Stamp
$20,907.		Updated [signature]	RECEIVED APR 15 1996 PORCUPINE MINING DIVISION
	Deemed Approval Date: July 14/96	Date Approved	
	Date Notice for Amendments Sent		

0241 (03/91)

10202

Grid A

Work Report #	Claim #	Units	Value of Assessment	Value Applied	Value Assigned	Reserve Work
	1204304	5	1144	0	1144	0
	1204305	6	1472	0	1472	0
	1204317	2	~~397~~ 393	0	~~390~~ 386	7
	1204325	1	155	0	155	0
	1204399	1	190	0	190	0
	1204701	4	702	1900	~~702~~	0
	1204702	4	736	1900	~~736~~	0
	1204703	4	736	1900	~~736~~	0
	1204704	4	702	1900	~~702~~	0
	1204706	14	2530	5900	~~2530~~	0
	1204707	1	127	700	~~127~~	0
	1204708	16	2496	6700	~~2496~~	0
	1198993	1	138	0	138	0
	1204309	2	270	0	270	0
	1204310	2	328	0	328	0
	1204321	6	851	0	851	0
	1204322	6	828	0	828	0
	1204323	1	81	0	81	0
	1204327	9	535	0	535	0
	1204328	2	81	0	81	0
	1204342	4	736	0	736	0
	1204343	4	736	0	736	0
	1204344	4	736	0	736	0
	1204345	4	713	0	713	0
	1204346	6	1104	0	1104	0
	1204347	2	368	0	368	0
	1204348	9	1645	0	1645	0
	1204349	2	374	0	374	0
Totals	28	126	20907	20900	~~20900~~ 12871	7

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JUN 6 - 1996
MINING LANDS BRANCH

Credits you are claiming in this report may be cut back. In order to minimize the adverse effects of such deletions, please indicate from which claims you wish to priorize the deletion of credits. Please mark (✓) one of the following:

1. ☐ Credits are to be cut back starting with the claim listed last, working backwards.
2. ☒ Credits are to be cut back equally over all claims contained in this report of work.
3. ☐ Credits are to be cut back as priorized on the attached appendix.

In the event that you have not specified your choice of priority, option one will be implemented.

Note 1: Examples of beneficial interest are unrecorded transfers, option agreements, memorandum of agreements, etc., with respect to the mining claims.

Note 2: If work has been performed on patented or leased land, please complete the following:

I certify that the recorded holder had a beneficial interest in the patented or leased land at the time the work was performed.	Signature	Date

Ministry of Northern Development and Mines
Ontario

Ministère du Développement du Nord et des mines

Statement of Costs for Assessment Credit

État des coûts aux fins du crédit d'évaluation

Mining Act/Loi sur les mines

Transaction No./N° de transaction W9660.00267

2.16592

Personal information collected on this form is obtained under the authority of the **Mining Act**. This information will be used to maintain a record and ongoing status of the mining claim(s). Questions about this collection should be directed to the Provincial Manager, Minings Lands, Ministry of Northern Development and Mines, 4th Floor, 159 Cedar Street, Sudbury, Ontario P3E 6A5, telephone (705) 670-7264.

Les renseignements personnels contenus dans la présente formule sont recueillis en vertu de la **Loi sur les mines** et serviront à tenir à jour un registre des concessions minières. Adresser toute quesiton sur la collece de ces renseignements au chef provincial des terrains miniers, ministère du Développement du Nord et des Mines, 159, rue Cedar, 4e étage, Sudbury (Ontario) P3E 6A5, téléphone (705) 670-7264.

1. Direct Costs/Coûts directs

Type	Description	Amount Montant	Totals Total global
Wages Salaires	Labour Main-d'oeuvre		
	Field Supervision Supervision sur le terrain		
Contractor's and Consultant's Fees Droits de l'entrepreneur et de l'expert-conseil	Type Airborne Mag and Em	20,907	
			20,907
Supplies Used Fournitures utilisées	Type		
Equipment Rental Location de matériel	Type		
		Total Direct Costs Total des coûts directs	20,907

2. Indirect Costs/Coûts indirects

** **Note:** When claiming Rehabilitation work Indirect costs are not allowable as assessment work.
Pour le remboursement des travaux de réhabilitation, les coûts indirects ne sont pas admissibles en tant que travaux d'évaluation.

Type	Description	Amount Montant	Totals Total global
Transportation Transport	Type		
Food and Lodging Nourriture et hébergement			
Mobilization and Demobilization Mobilisation et démobilisation			
		Sub Total of Indirect Costs Total partiel des coûts indirects	
Amount Allowable (not greater than 20% of Direct Costs) Montant admissible (n'excédant pas 20 % des coûts directs)			
Total Value of Assessment Credit (Total of Direct and Allowable Indirect costs)	**Valeur totale du crédit d'évaluation (Total des coûts directs et indirects admissibles**		20,907

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JUN 6 - 1996
MINING LANDS BRANCH

Note: The recorded holder will be required to verify expenditures claimed in this statement of costs within 30 days of a request for verification. If verification is not made, the Minister may reject for assessment work all or part of the assessment work submitted.

Note : Le titulaire enregistré sera tenu de vérifier les dépenses demandées dans le présent état des coûts dans les 30 jours suivant une demande à cet effet. Si la vérification n'est pas effectuée, le ministre peut rejeter tout ou une partie des travaux d'évaluation présentés.

Filing Discounts

1. Work filed within two years of completion is claimed at 100% of the above Total Value of Assessment Credit.
2. Work filed three, four or five years after completion is claimed at 50% of the above Total Value of Assessment Credit. See calculations below:

Total Value of Assessment Credit		Total Assessment Claimed
	× 0.50 =	

Remises pour dépôt

1. Les travaux déposés dans les deux ans suivant leur achèvement sont remboursés à 100 % de la valeur totale susmentionnée du crédit d'évaluation.
2. Les travaux déposés trois, quatre ou cinq ans après leur achèvement sont remboursés à 50 % de la valeur totale du crédit d'évaluation susmentionné. Voir les calculs ci-dessous.

Valeur totale du crédit d'évaluation		Évaluation totale demandée
	× 0,50 =	

Certification Verifying Statement of Costs

I hereby certify:
that the amounts shown are as accurate as possible and these costs were incurred while conducting assessment work on the lands shown on the accompanying Report of Work form.

that as District Manager, Exploration (Recorded Holder, Agent, Position in Company) I am authorized

to make this certification

Attestation de l'état des coûts

J'atteste par la présente :
que les montants indiqués sont le plus exact possible et que ces dépenses ont été engagées pour effectuer les travaux d'évaluation sur les terrains indiqués dans la formule de rapport de travail ci-joint.

Et qu'à titre de ______________ je suis autorisé (titulaire enregistré, représentant, poste occupé dans la compagnie)

à faire cette attestation.

Signature	Date
[signature]	April 15 - 96.

0212 (04/91)

Nota : Dans cette formule, lorsqu'il désigne des personnes, le masculin est utilisé au sens neutre.

Ministry of
Northern Development
and Mines

Ministère du
Développement du Nord
et des Mines

Ontario

Geoscience Assessment Office
933 Ramsey Lake Road
6th Floor
Sudbury, Ontario
P3E 6B5

Telephone: (705) 670-5853
Fax: (705) 670-5863

September 12, 1996

Gary White
Mining Recorder
60 Wilson Avenue, 1st Floor
Timmins, ON
P4N 2S7

Dear Sir or Madam:

Submission Number: 2.16592

Subject: Transaction Number(s): W9660.00267

After reviewing the Work Report(s) we have prepared this letter and the attached summary, which lists the results of our review. Requirements of the Assessment Work Regulation may not have been fully met. Please examine the summary to determine the next course of action concerning the identified Work Report(s).

NOTE: The 90 day deemed approval provision, subsection 6(7) of the Assessment Work Regulation, is no longer in effect for this submission.

PLEASE NOTE ANY REQUESTED REVISIONS MUST BE SUBMITTED IN DUPLICATE.

If the anniversary dates for the mining claims affected by this correspondence have not passed, a number of options are available. Please contact the Mining Recorder to discuss these options.

If you have any questions regarding this correspondence, please contact Lucille Jerome at (705)670-5858.

Yours sincerely,

ORIGINAL SIGNED BY
Ron C. Gashinski
Senior Manager, Mining Lands Section
Mines and Minerals Division

Correspondence ID: 10202
Copy for: Assessment Library

Work Report Assessment Results

Submission Number: 2.16592

Date Correspondence Sent: September 12, 1996 **Assessor:** Lucille Jerome

Transaction Number	First Claim Number	Township(s) / Area(s)	Status	Approval Date
W9660.00267	1204304	ADAMS, ELDORADO	Approval After Notice	September 06, 1996

Section:

15 Airborne Geophy AMAG
15 Airborne Geophy AEM

Correspondence to:

Mining Recorder
Timmins, ON

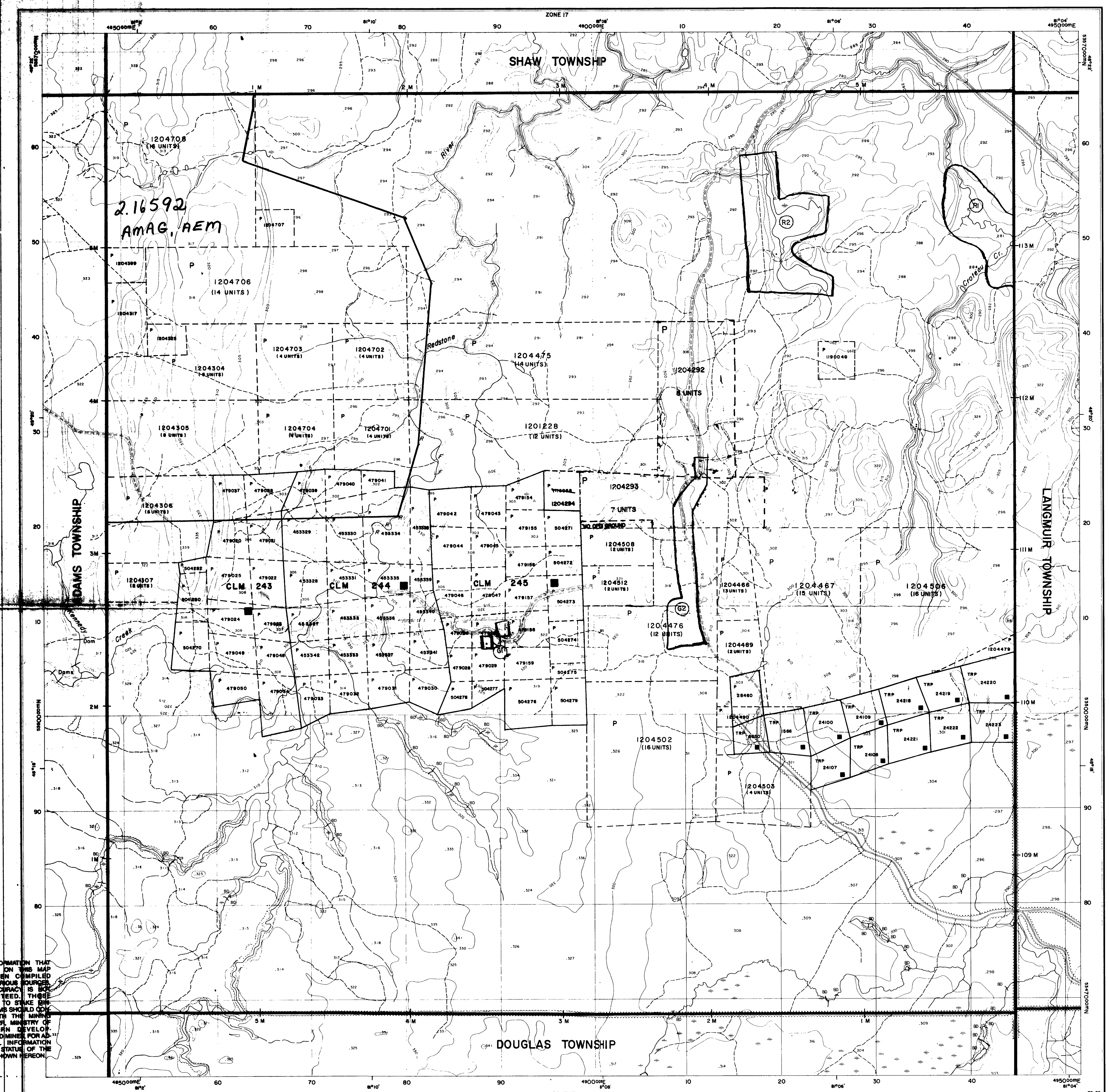
Resident Geologist
Timmins, ON

Assessment Files Library
Sudbury, ON

Other Recorded Holder(s) and/or Agent(s):

OUTOKUMPU MINES LTD.
TORONTO, Ontario

Correspondence ID: 10202



Ministry of Natural Resources — Ministry of Northern Development and Mines — Ontario

G-4001

INDEX TO LAND DISPOSITION

PLAN
G-4001

TOWNSHIP
ELDORADO

M.N.R. ADMINISTRATIVE DISTRICT
TIMMINS
MINING DIVISION
PORCUPINE
LAND TITLES/REGISTRY DIVISION
COCHRANE

2.16592

Scale 1:20 000

Contour Interval 10 Metres

RECEIVED
JUN 6 - 1996
MINING LANDS BRANCH

SYMBOLS

Boundary
- Township, Meridian, Baseline
- Road allowance; surveyed
- shoreline
- Lot/Concession; surveyed
- unsurveyed
- Parcel; surveyed
- unsurveyed
- Right-of-way; road
- railway
- utility
- Reservation
- Cliff, Pit, Pile
- Contour
- Interpolated
- Approximate
- Depression
- Control point (horizontal)
- Flooded land
- Mine head frame
- Pipeline (above ground)
- Railway; single track
- double track
- abandoned
- Road; highway, county, township
- access
- trail, bush
- Shoreline (original)
- Transmission line
- Wooded area

AREAS WITHDRAWN FROM DISPOSITION

MRO - Mining Rights Only
SRO - Surface Rights Only
M+S - Mining and Surface Rights

Description	Order No.	Date	Disposition	File

- G1 GRAVEL, FILE 192287
- G2 GRAVEL, FILE 171598 AND FILE 172954
- R1 DUCKS UNLIMITED - PENDING APPLICATION UNDER THE PUBLIC LANDS ACT. S.R.O. WITHDRAWN
- R2 DUCKS UNLIMITED - PENDING APPLICATION UNDER THE PUBLIC LANDS ACT. S.R.O. WITHDRAWN

ISSUED
JUN 5 1996
PORCUPINE MINING DIVISION

DISPOSITION OF CROWN LANDS

Patent
- Surface & Mining Rights
- Surface Rights Only
- Mining Rights Only

Lease
- Surface & Mining Rights
- Surface Rights Only
- Mining Rights Only

- Licence of Occupation
- Order-in-Council
- Cancelled
- Reservation
- Sand & Gravel

ELDORADO TWP

ACTIVATED JULY 11, 1995 BY:

Map base and land disposition drafting by Surveys and Mapping Branch, Ministry of Natural Resources.

The disposition of land, location of lot fabric and parcel boundaries on this index was compiled for administrative purposes only.

G-4001

42A06SE0082 2.16592 ELDORADO

200

MAP SYMBOLOGY

Aerial Cableway
Boundary
International
Interprovincial
District, Township, Indian Reserve
Approximate
Lot, Concession
Approximate
Park Boundary
Bridge
Road, Railroad
Building
Chimney
Cliff, Pit, Pile
Contours
Interpolated
Approximate
Depression
Control Points
Horizontal
Vertical
Culvert
Falls
Double line river
Fence, Hedge, Wall
Feature Outline (Construction features, etc.)
Flooded Land
Lock
Marsh or Swamp
Mast
Mine Head Frame
Outcrop

Pipeline (above ground)
Railroad
Single Track
Double Track
Abandoned
Turntable
Road
Highway, County Township
Access (road of doubtful maintenance or significant driveway)
Trail, Bush Road (portage, alley)
Rapids
Double line river with multiple rapids
Double line river with multiple rapids
Reservoir
River, Stream, Canal
Approximate
Direction of flow
Rock
Significant
Shoal
Spot Elevation (lake elevations)
Tower
Transmission Line
Poles
Pylons
Tunnel
Utility Poles
Wharf, Dock, Pier
Wooded Area

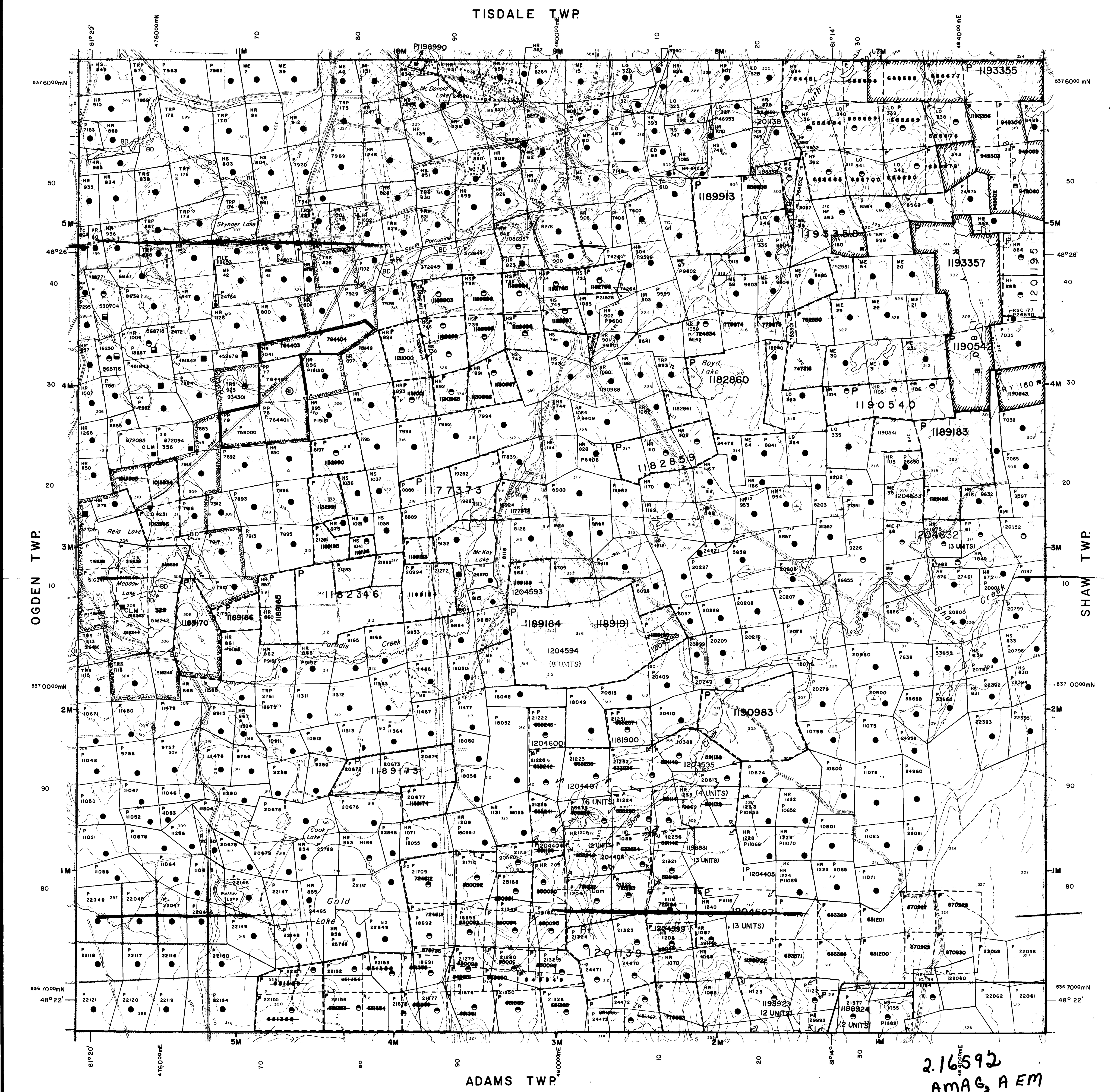
AREAS WITHDRAWN FROM DISPOSITION

M.R.O. – MINING RIGHTS ONLY
S.R.O. – SURFACE RIGHTS ONLY
M.+ S. – MINING AND SURFACE RIGHTS

Description	Order No.	Date	Disposition	File
	W-P-17/92 NR	92-FEB-24	S.R.O.	

(APPLICATION UNDER THE PUBLIC LANDS ACT FOR A WASTE DISPOSAL SITE.)

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.



LEGEND

HIGHWAY AND ROUTE No.
OTHER ROADS
TRAILS
SURVEYED LINES:
TOWNSHIPS, BASE LINES, ETC.
LOTS, MINING CLAIMS, PARCELS, ETC.
UNSURVEYED LINES:
LOT LINES
PARCEL BOUNDARY
MINING CLAIMS ETC.
RAILWAY AND RIGHT OF WAY
UTILITY LINES
NON-PERENNIAL STREAM
FLOODING OR FLOODING RIGHTS
SUBDIVISION OR COMPOSITE PLAN
RESERVATIONS
ORIGINAL SHORELINE
MARSH OR MUSKEG
MINES
TRAVERSE MONUMENT

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
" , SURFACE RIGHTS ONLY	◒
" , MINING RIGHTS ONLY	◓
LEASE, SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	◧
" , MINING RIGHTS ONLY	◨
LICENCE OF OCCUPATION	▼
ORDER-IN-COUNCIL	OC
RESERVATION	®
CANCELLED	⊗
SAND & GRAVEL	Ⓢ

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1.

SCALE 1:20 000
GRID ZONE : 17

NOTES

REGISTERED PLAN OF SUBDIVISION

MINING CLAIMS SHOWN WITHIN THIS AREA ARE SUBJECT TO THE RIGHTS AND PRIVILEGES GRANTED TO DELNITE MINES LTD. UNDER AN EASEMENT ORDER DATED MAY 19, 1937.

DOME MINES, LIMITED SURFACE RIGHTS LEASE #103926

RECEIVED
OCT 1 9 1994
MINING LANDS BRANCH

ISSUED
OCT 1 3 1994
PORCUPINE MINING DIVISION

~~2.15647~~

2.16592
AMAG, AEM

TOWNSHIP
DELORO
M.N.R. ADMINISTRATIVE DISTRICT
TIMMINS
MINING DIVISION
PORCUPINE
LAND TITLES / REGISTRY DIVISION
COCHRANE

Ontario
Ministry of Natural Resources
Land Management Branch
ACTIVATED NOV 24/93 BY: D.C.

ORIGINAL COMPILATION: JULY 1984
Number: G-3993
REVISED
CHECKED BY: A.R.W. NOV 23/93

G-3925

AREAS ...

M.R.O. – MINING RIG... ...Y

S.R.O. – SURFACE RIGHTS ONLY

M.+ S. – MINING AND SURFACE RIGHTS

Description	Order No.	Date	Disposition	File
(R1) MNR RESERVE	#25/77	MARCH 1/77	SRO	168543
(R3) BFI UNDER PLA – SCOUTCAMP – SEE LANDROLL – OCT 31/84				

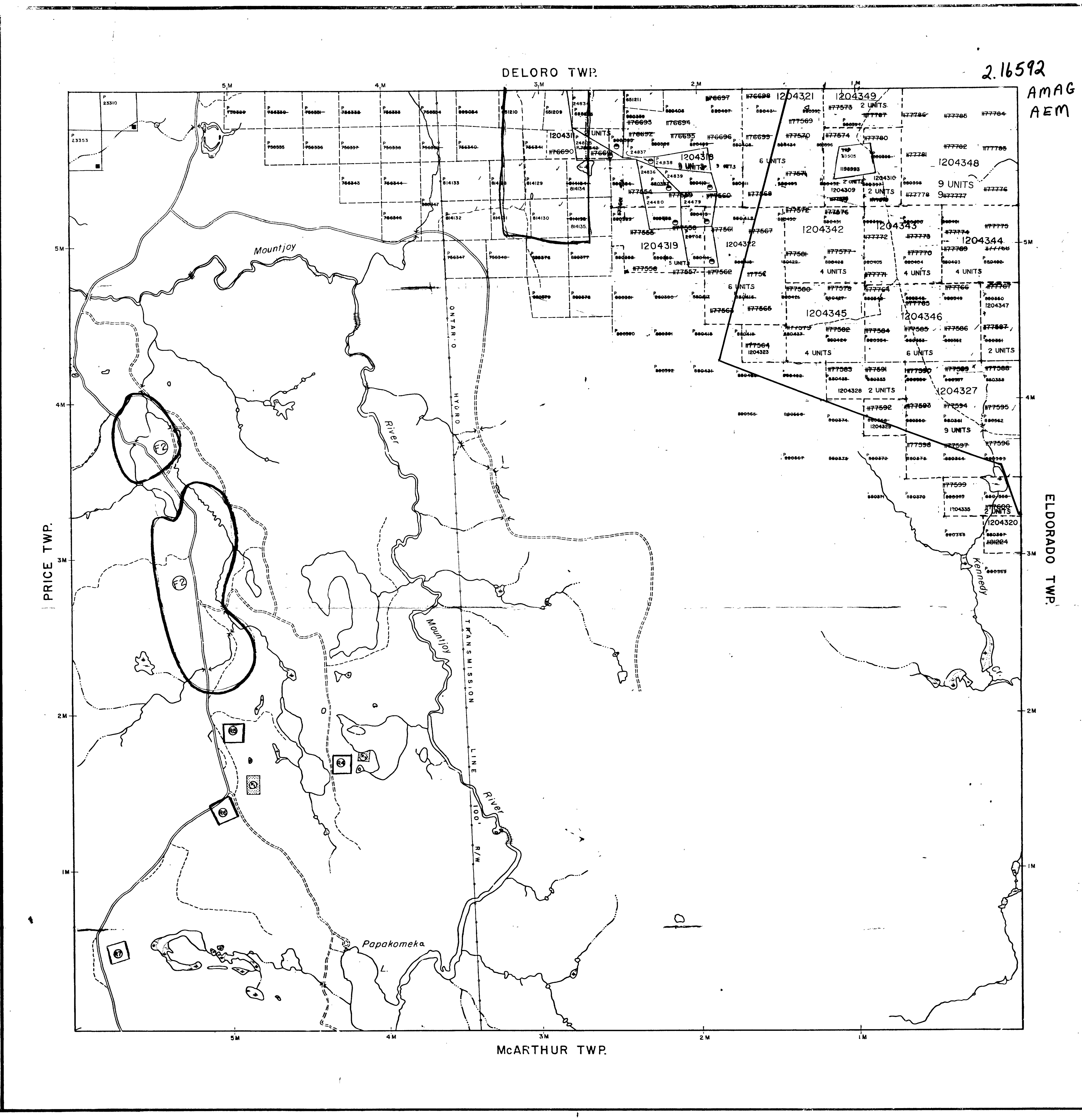
(R4) MINING AND SURFACE RIGHTS WITHDRAWN FROM PROSPECTING, STAKING OUT, SALE OR LEASE UNDER SECTION 35 OF THE MINING ACT R.S.O. 1990 ORDER NO. W-P 56/94 NER DATED 94-MAY-02

(R5) MINING AND SURFACE RIGHTS WITHDRAWN FROM PROSPECTING, STAKING OUT, SALE OR LEASE UNDER SECTION 35 OF THE MINING ACT R.S.O. 1990 ORDER NO. W-P 57/94 NER DATED 94-MAY-02

(R6) MINING AND SURFACE RIGHTS WITHDRAWN FROM PROSPECTING, STAKING OUT, SALE OR LEASE UNDER SECTION 35 OF THE MINING ACT R.S.O. 1990 ORDER NO. W-P 58/94 NER DATED 94-MAY-02

(R7) MINING AND SURFACE RIGHTS WITHDRAWN FROM PROSPECTING, STAKING OUT, SALE OR LEASE UNDER SECTION 35 OF THE MINING ACT R.S.O. 1990 ORDER NO. W-P 59/94 NER DATED 94-MAY-02

THE INFORMATION THAT APPEARS ON THIS MAP HAS BEEN COMPILED FROM VARIOUS SOURCES, AND ACCURACY IS NOT GUARANTEED. THOSE WISHING TO STAKE MINING CLAIMS SHOULD CONSULT WITH THE MINING RECORDER, MINISTRY OF NORTHERN DEVELOPMENT AND MINES, FOR ADDITIONAL INFORMATION ON THE STATUS OF THE LANDS SHOWN HEREON.



LEGEND

HIGHWAY AND ROUTE No
OTHER ROADS
TRAILS
SURVEYED LINES
TOWNSHIPS, BASE LINES, ETC.
LOTS, MINING CLAIMS, PARCELS, ETC.
UNSURVEYED LINES
LOT LINES
PARCEL BOUNDARY
MINING CLAIMS ETC
RAILWAY AND RIGHT OF WAY
UTILITY LINES
NON PERENNIAL STREAM
FLOODING OR FLOODING RIGHTS
SUBDIVISION OR COMPOSITE PLAN
RESERVATIONS
ORIGINAL SHORELINE
MARSH OR MUSKEG
MINES
TRAVERSE MONUMENT

DISPOSITION OF CROWN LANDS

TYPE OF DOCUMENT	SYMBOL
PATENT, SURFACE & MINING RIGHTS	●
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" , MINING RIGHTS ONLY	
LEASE, SURFACE & MINING RIGHTS	■
" , SURFACE RIGHTS ONLY	
" , MINING RIGHTS ONLY	
LICENCE OF OCCUPATION	▼
ORDER-IN-COUNCIL	OC
RESERVATION	(R)
CANCELLED	⊗
SAND & GRAVEL	(S)

NOTE: MINING RIGHTS IN PARCELS PATENTED PRIOR TO MAY 6, 1913, VESTED IN ORIGINAL PATENTEE BY THE PUBLIC LANDS ACT, R.S.O. 1970, CHAP. 380, SEC. 63, SUBSEC. 1

Metres 500 0 1000 Metres

Chains 10 0 10 20 30 40 50 60 70 Chains

Feet 500 0 1000 2000 3000 4000 5000 Feet

SCALE 1:20 000

(F2) THIS TWP. SUBJECT TO FOREST ACTIVITY IN 1994/95 FURTHER INFORMATION AVAILABLE ON FILE

ISSUED
NOV - 3 1994
PORCUPINE MINING DIVISION

~~2.15681~~

RECEIVED
NOV 8 1994
MINING LANDS BRANCH

TOWNSHIP
ADAMS

M.N.R. ADMINISTRATIVE DISTRICT
TIMMINS

MINING DIVISION
PORCUPINE

LAND TITLES / REGISTRY DIVISION
COCHRANE

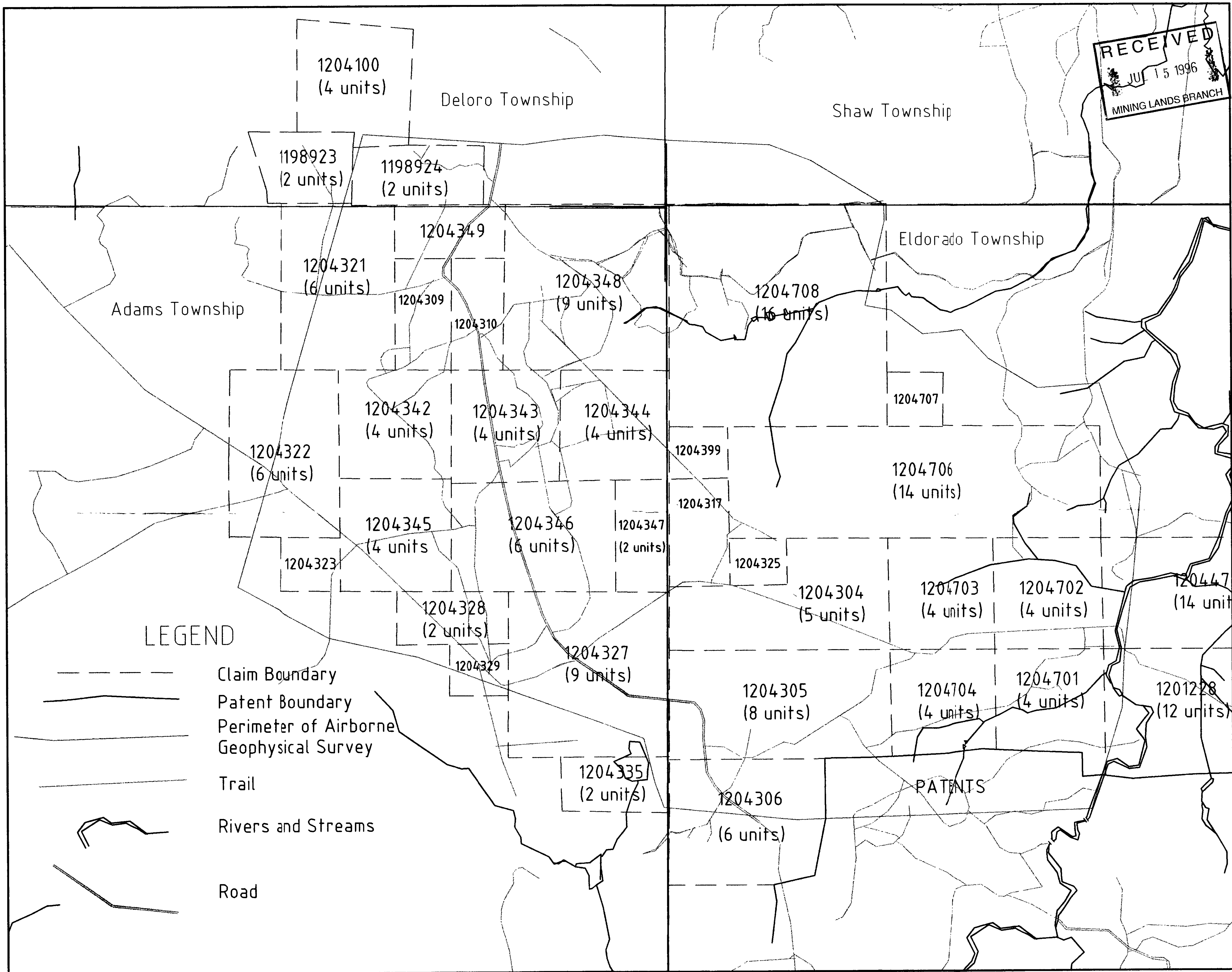
Ministry of Natural Resources
Ministry of Northern Development and Mines
Ontario

Date SEPTEMBER, 1986

Number G-3925

ADAMS

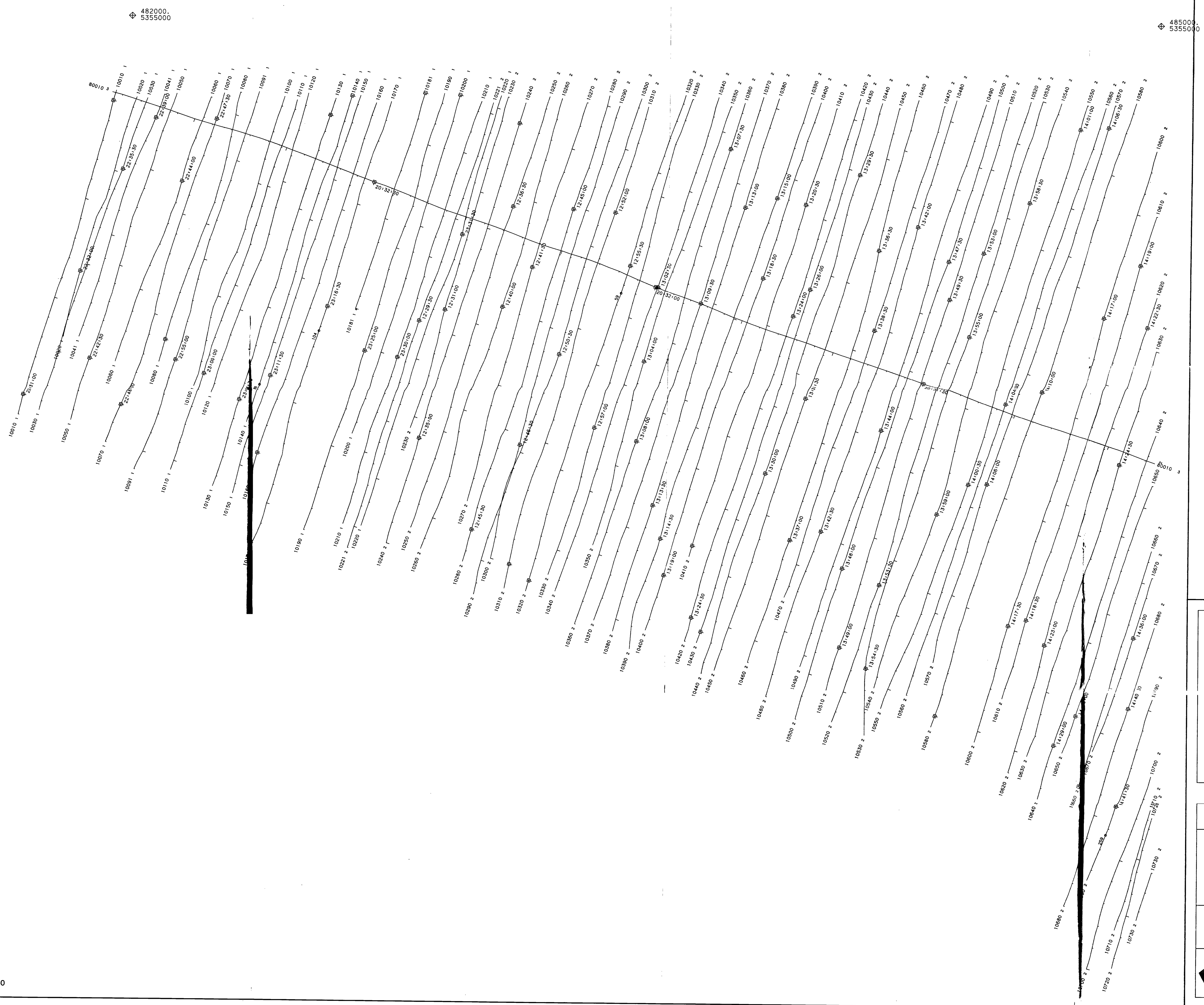
42A06SE0002 2.16592 ELDORADO 220



Scale	DATE	SHEET	Airborne Grid Outlines	Outokumpu Mines Ltd.
1:20000	09/07/96	1 of 1		
	REF No. 1	FILE NEWASSES.PLT		

42A06SE0082 2.16592 ELDORADO

230



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Anomalies

Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 16
- 16 - 32
- > 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

OUTOKUMPU MINES LTD.

FLIGHT PATH

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

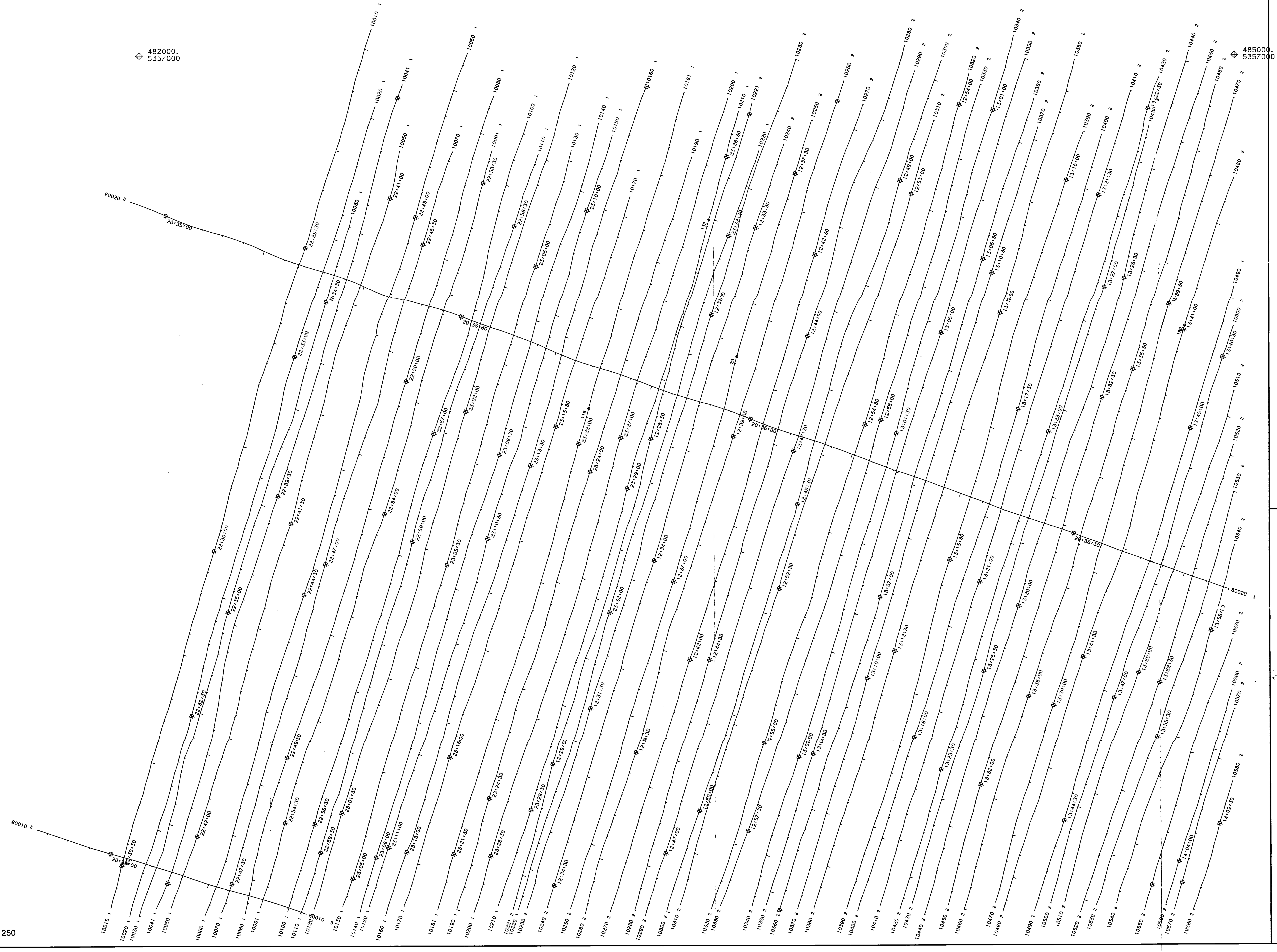
0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996
NTS No:
MAP No: 2 J9625- 1

240



Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

OUTOKUMPU MINES LTD.

FLIGHT PATH

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

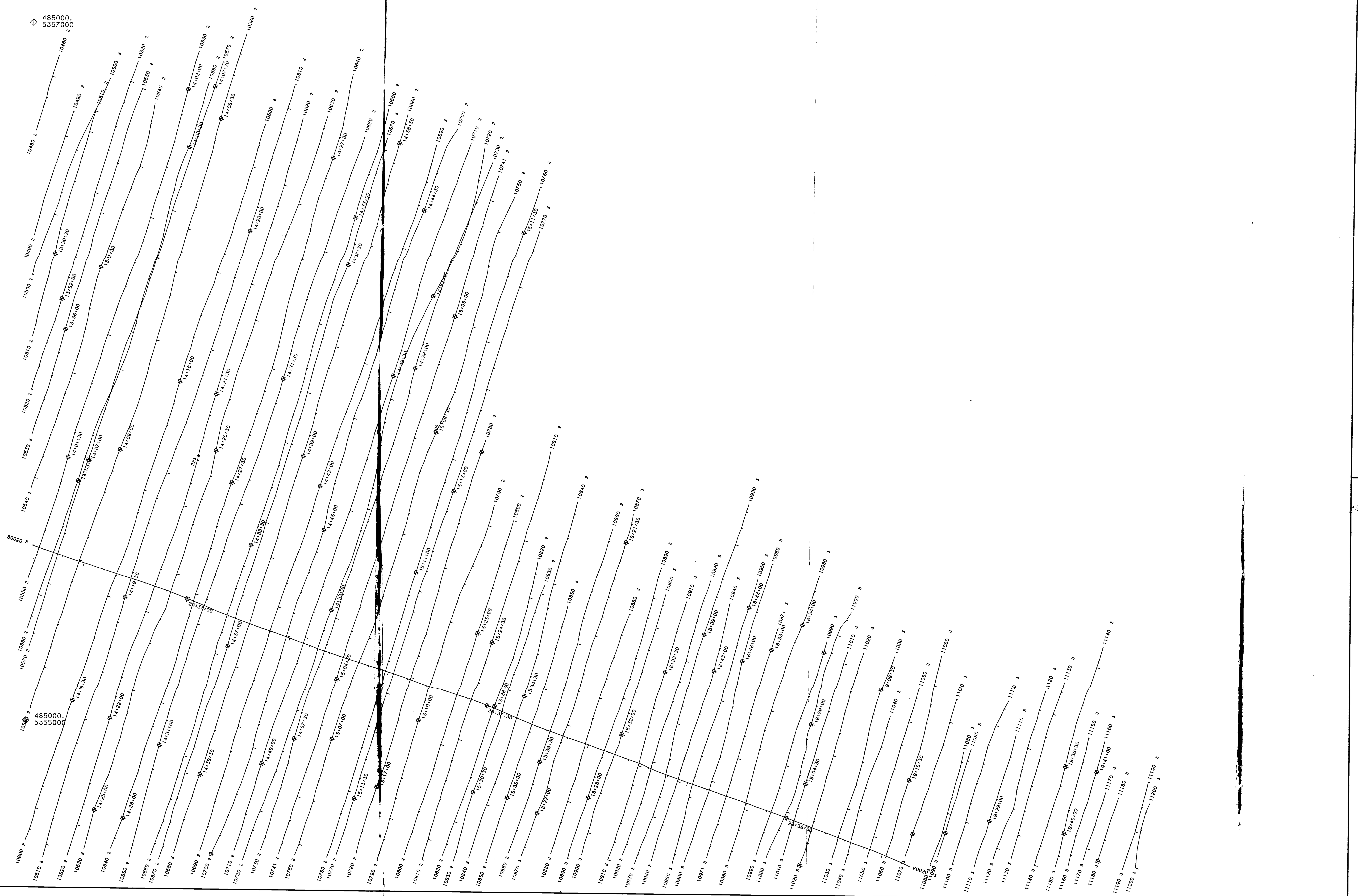
DATE: MARCH 1996

NTS No:

MAP No: 2 J9625- 2

42A06SE0062 2.16592 ELDORADO

250



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

OUTOKUMPU MINES LTD.

FLIGHT PATH

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

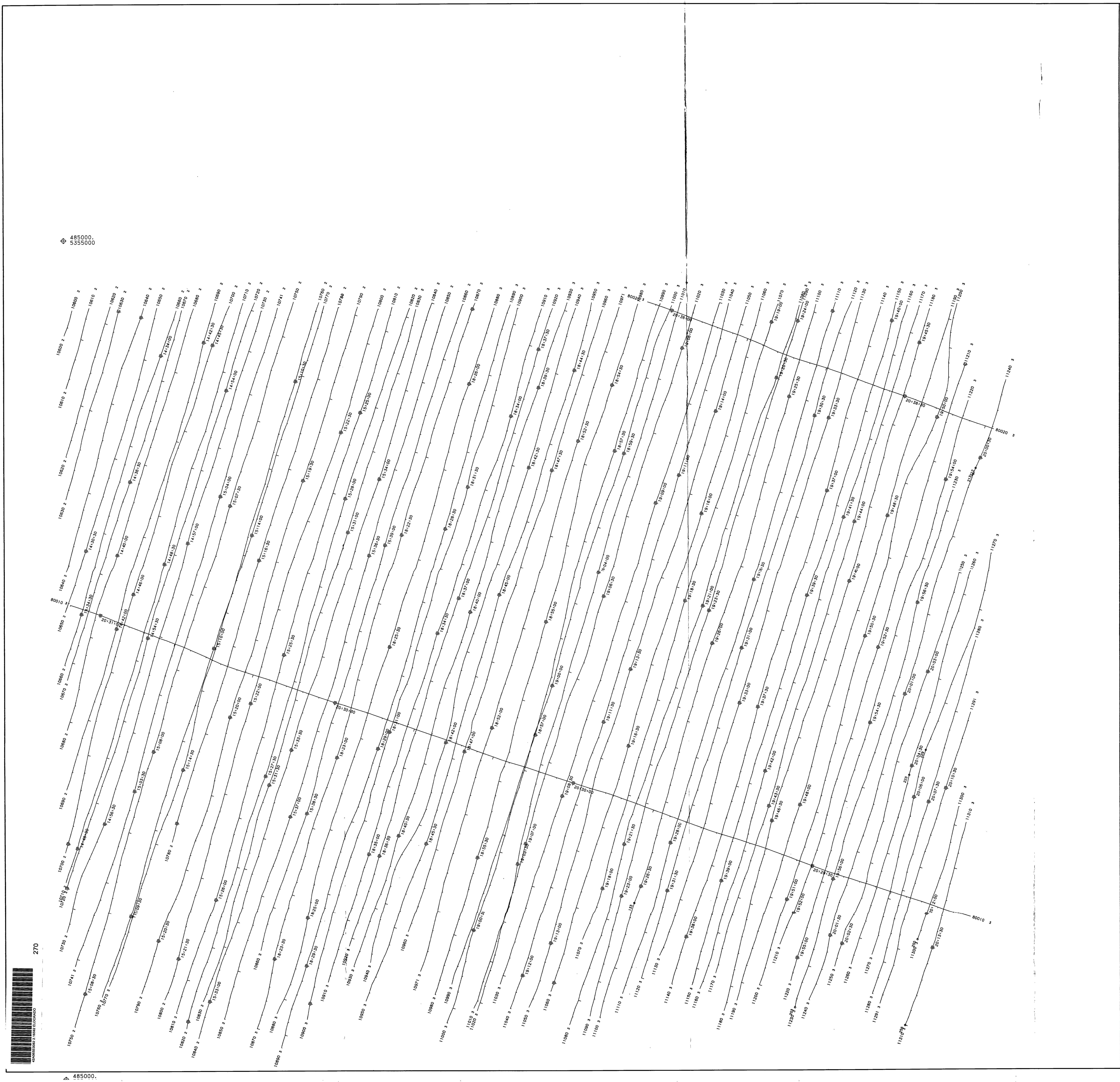
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 2 J9625- 3



Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

OUTOKUMPU MINES LTD.

FLIGHT PATH

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

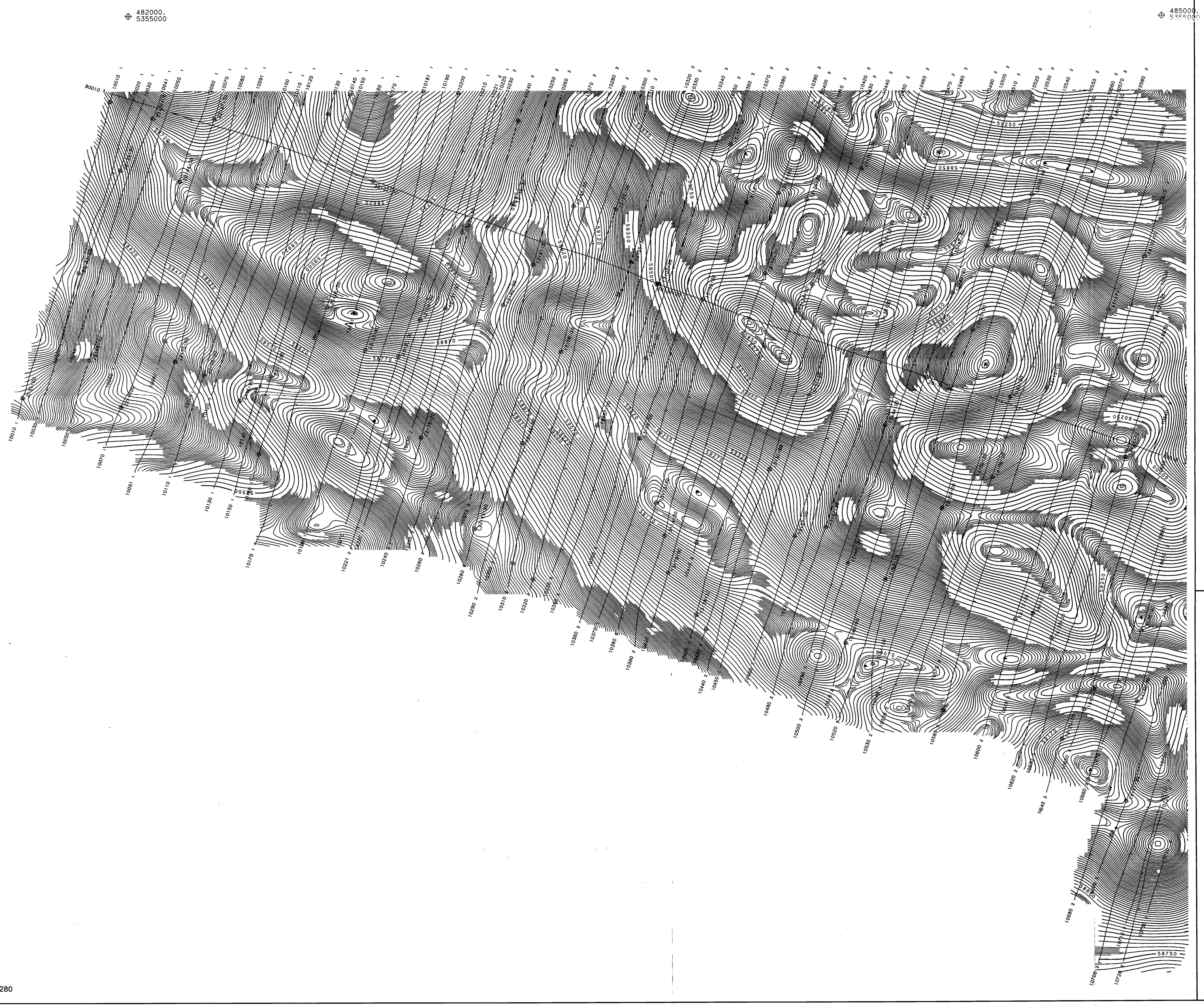
0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996
NTS No:
MAP No: 2 J9625- 4

270



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Magnetics

Total Field Magnetic Intensity Contours in nT.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

- 2 nT
- 10 nT
- 50 nT
- 250 nT
- 1000 nT

2.16592

OUTOKUMPU MINES LTD.

TOTAL FIELD MAGNETIC CONTOURS

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

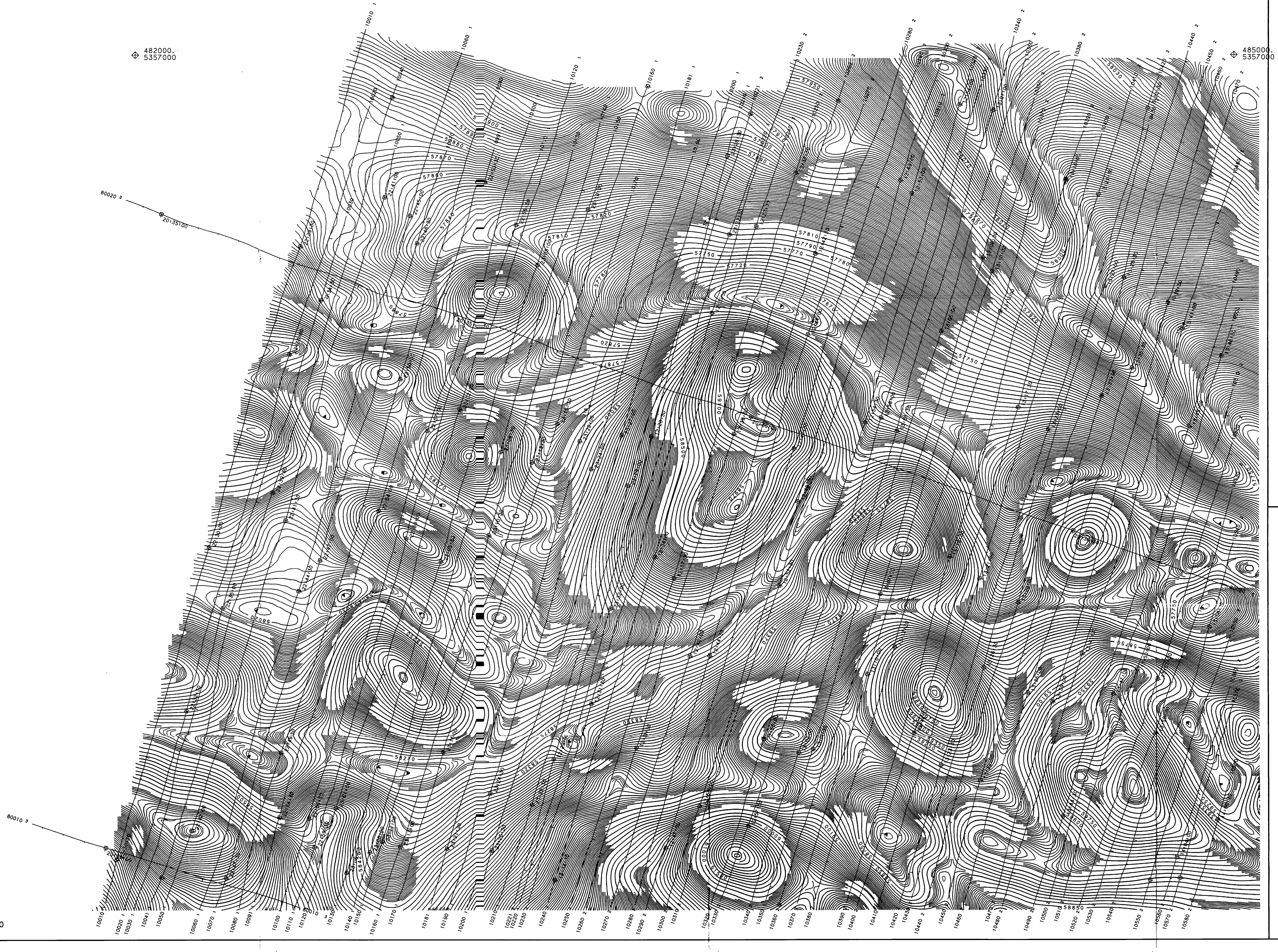
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 4 J9625- 1



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Magnetics

Total Field Magnetic Intensity Contours in nT.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

2 nT
10 nT
50 nT
250 nT
1000 nT

2.16592

OUTOKUMPU MINES LTD.

TOTAL FIELD MAGNETIC CONTOURS

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

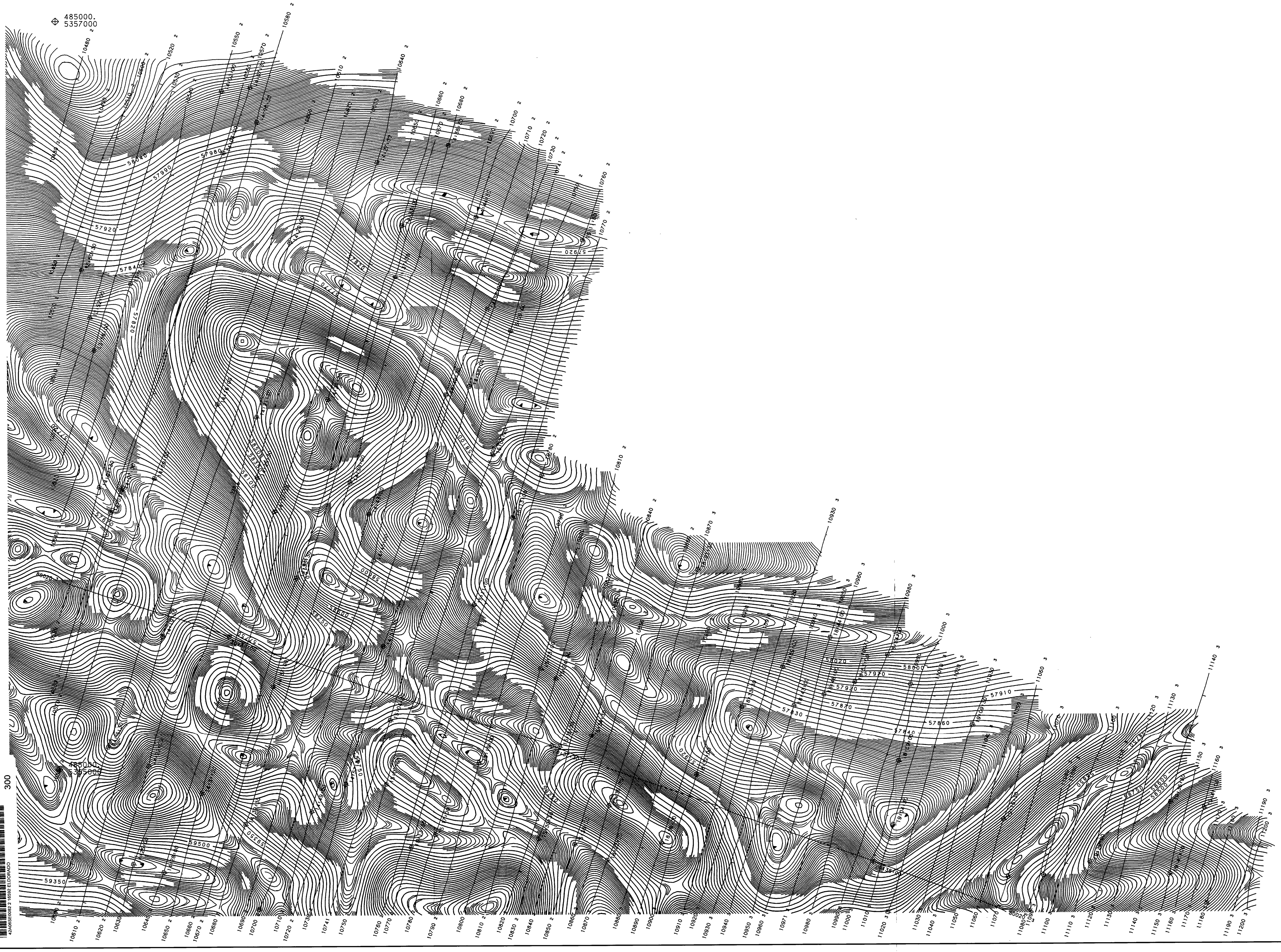
0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE:	MARCH 1996
NTS No:	
MAP No: 4	J9625- 2

290



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Magnetics

Total Field Magnetic Intensity Contours in nT.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below
2 nT
10 nT
50 nT
250 nT
1000 nT

OUTOKUMPU MINES LTD.

TOTAL FIELD MAGNETIC CONTOURS

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

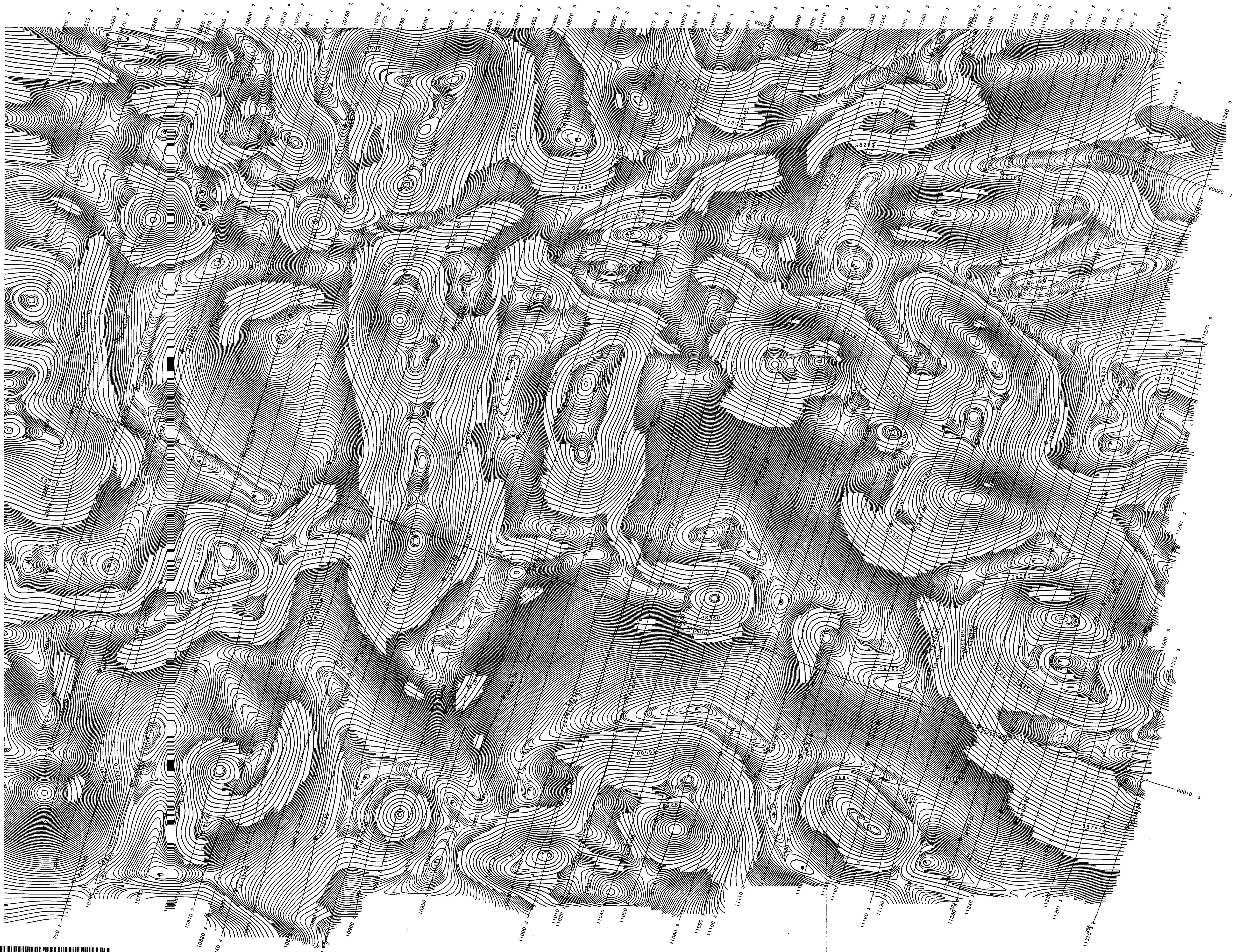
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 4 J9625- 3



Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Magnetics

Total Field Magnetic Intensity Contours in nT.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

- 2 nT
- 10 nT
- 50 nT
- 250 nT
- 1000 nT

2.16592

OUTOKUMPU MINES LTD.

TOTAL FIELD MAGNETIC CONTOURS

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

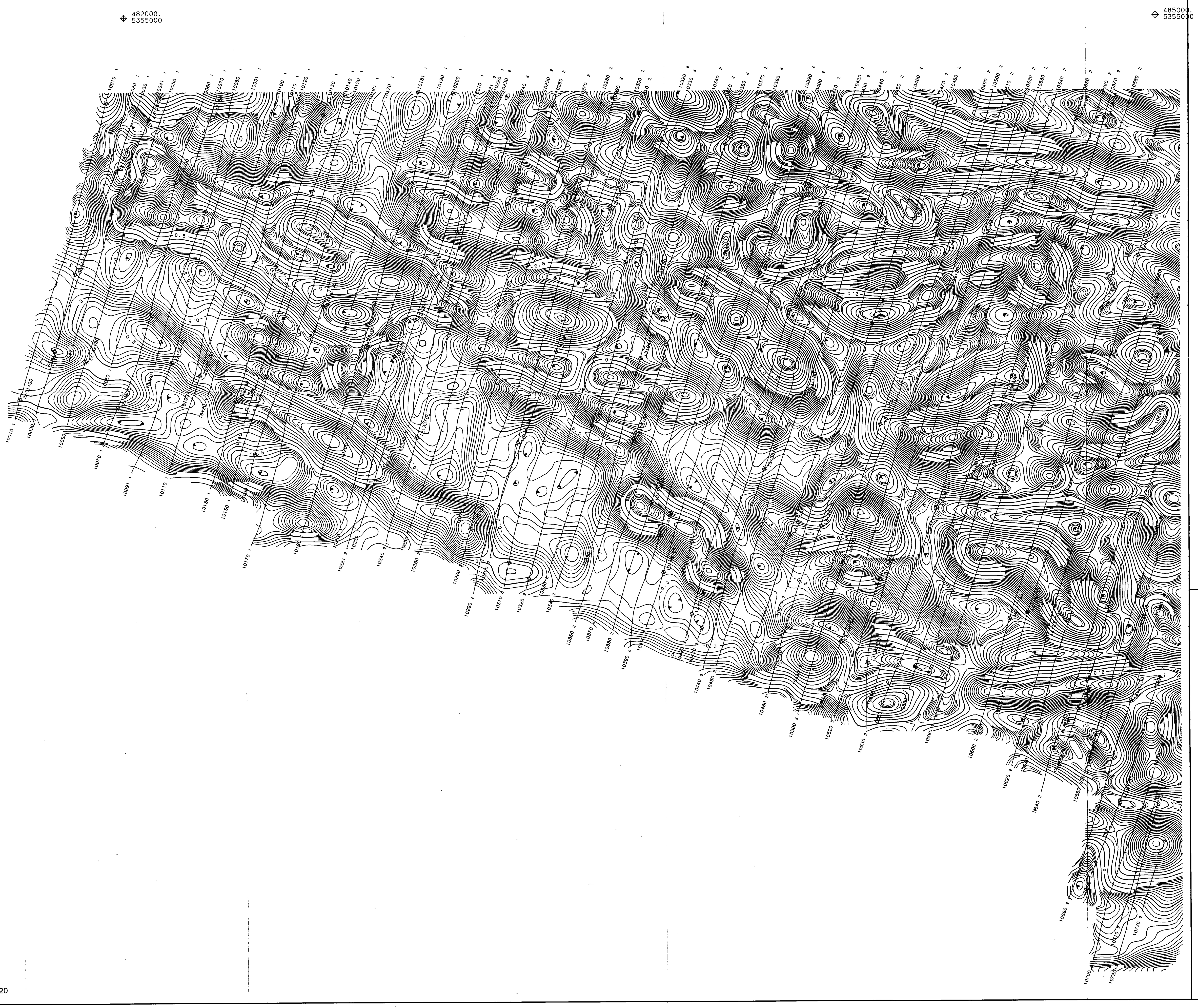
SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE:	MARCH 1996
NTS No:	
MAP No:	4 J9625- 4



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Vertical Gradient

Vertical Magnetic Gradient calculated from the total field magnetic intensity in nT/m.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

.05 nT
.25 nT
1.0 nT
5.0 nT
25.0 nT

OUTOKUMPU MINES LTD.

CALCULATED VERTICAL MAGNETIC GRADIENT

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

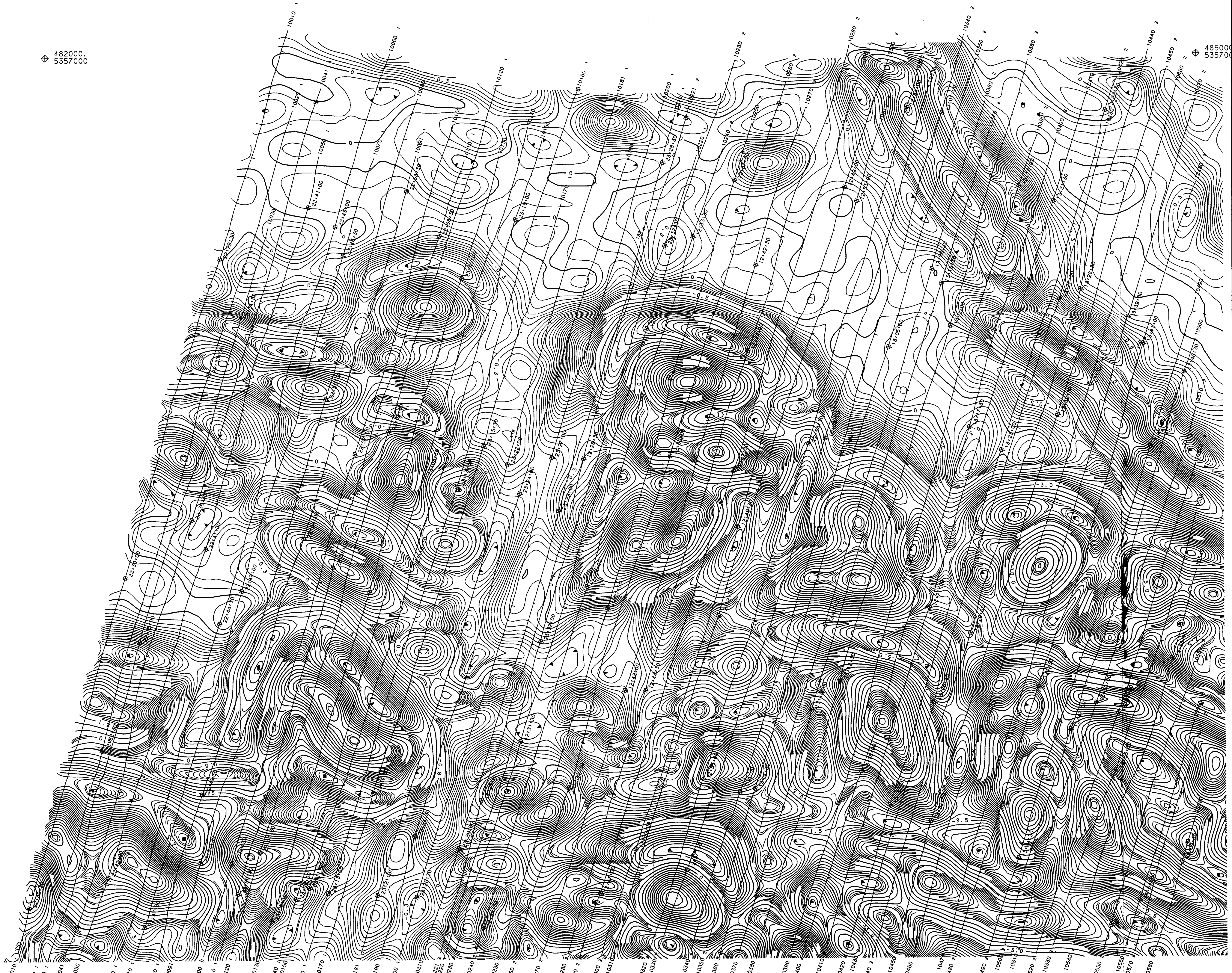
0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE:	MARCH 1996
NTS No:	
MAP No:	5 J9625- 1

320



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Vertical Gradient

Vertical Magnetic Gradient calculated from the total field magnetic intensity in nT/m.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

.05 nT
.25 nT
1.0 nT
5.0 nT
25.0 nT

OUTOKUMPU MINES LTD.

CALCULATED VERTICAL MAGNETIC GRADIENT

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

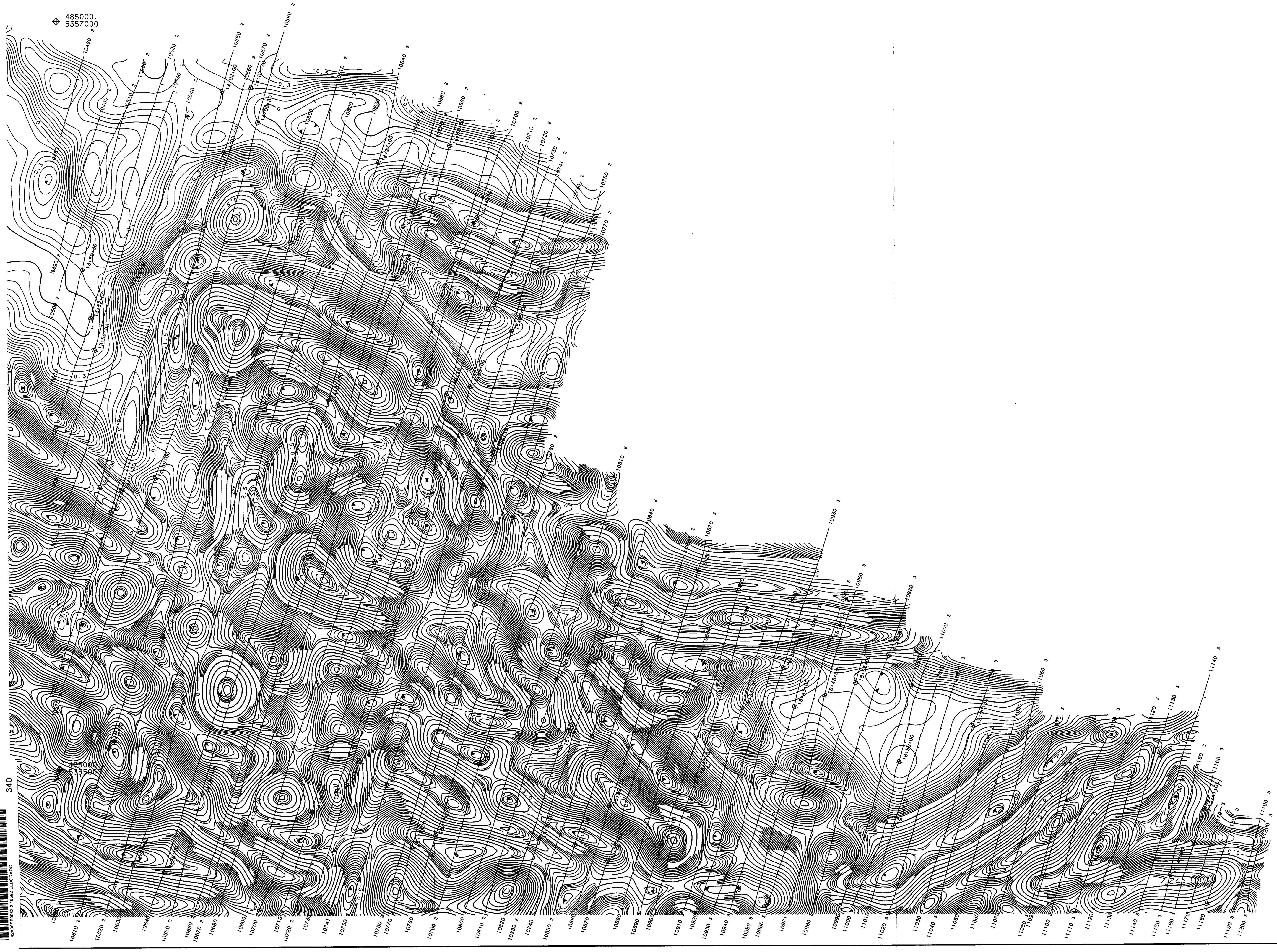
AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 5 J9625- 2

330



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Vertical Gradient

Vertical Magnetic Gradient calculated from the total field magnetic intensity in nT/m.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below

.05 nT
.25 nT
1.0 nT
5.0 nT
25.0 nT

489000.
5357000

OUTOKUMPU MINES LTD.

CALCULATED VERTICAL MAGNETIC GRADIENT

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

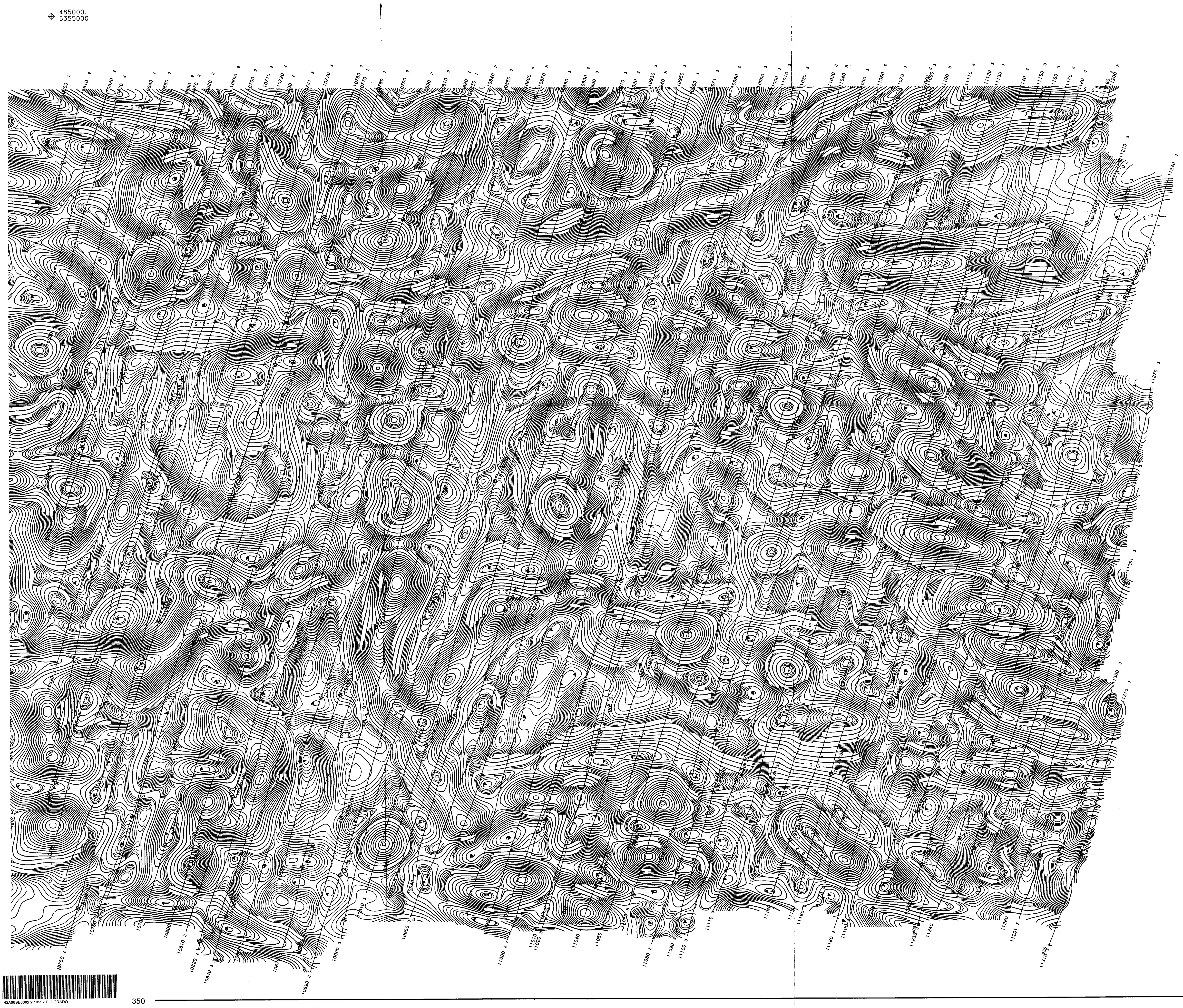
SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE:	MARCH 1996
NTS No:	
MAP No:	5 J9625- 3



Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Vertical Gradient

Vertical Magnetic Gradient calculated from the total field magnetic intensity in nT/m.

Cesium high sensitivity magnetometer.

Sensor elevation 45m

Map contours are multiples of those listed below
- .05 nT
- .25 nT
- 1.0 nT
- 5.0 nT
- 25.0 nT

OUTOKUMPU MINES LTD.

CALCULATED VERTICAL MAGNETIC GRADIENT

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

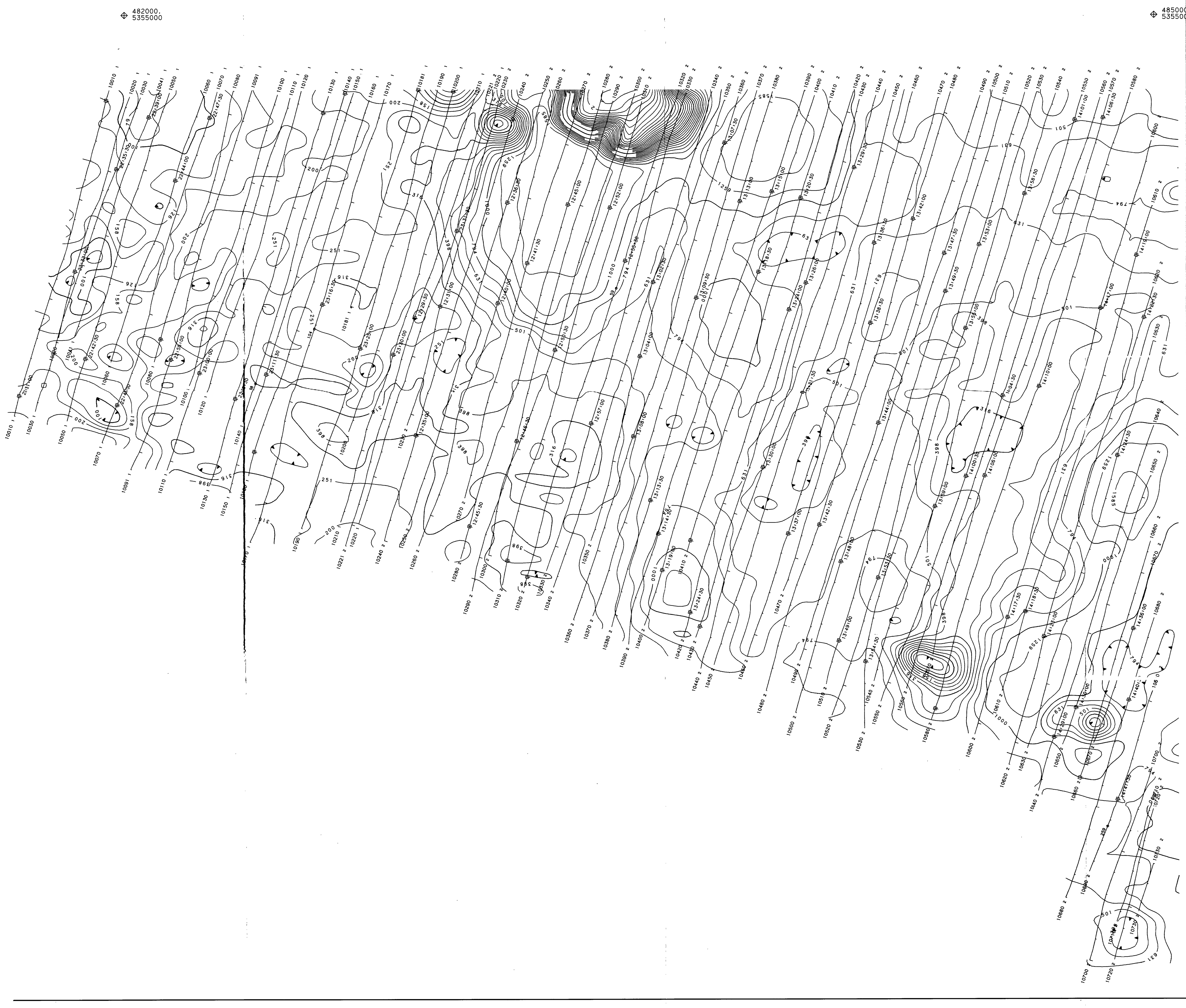
AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 5 J9625- 4

350



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 2739 Hz coplanar EM response assuming a 200 m conductive layer.

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

- 0.1 log(ohm*m)
- 0.5 log(ohm*m)
- 2.0 log(ohm*m)
- 5.00 log(ohm*m)

16592

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (2736 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

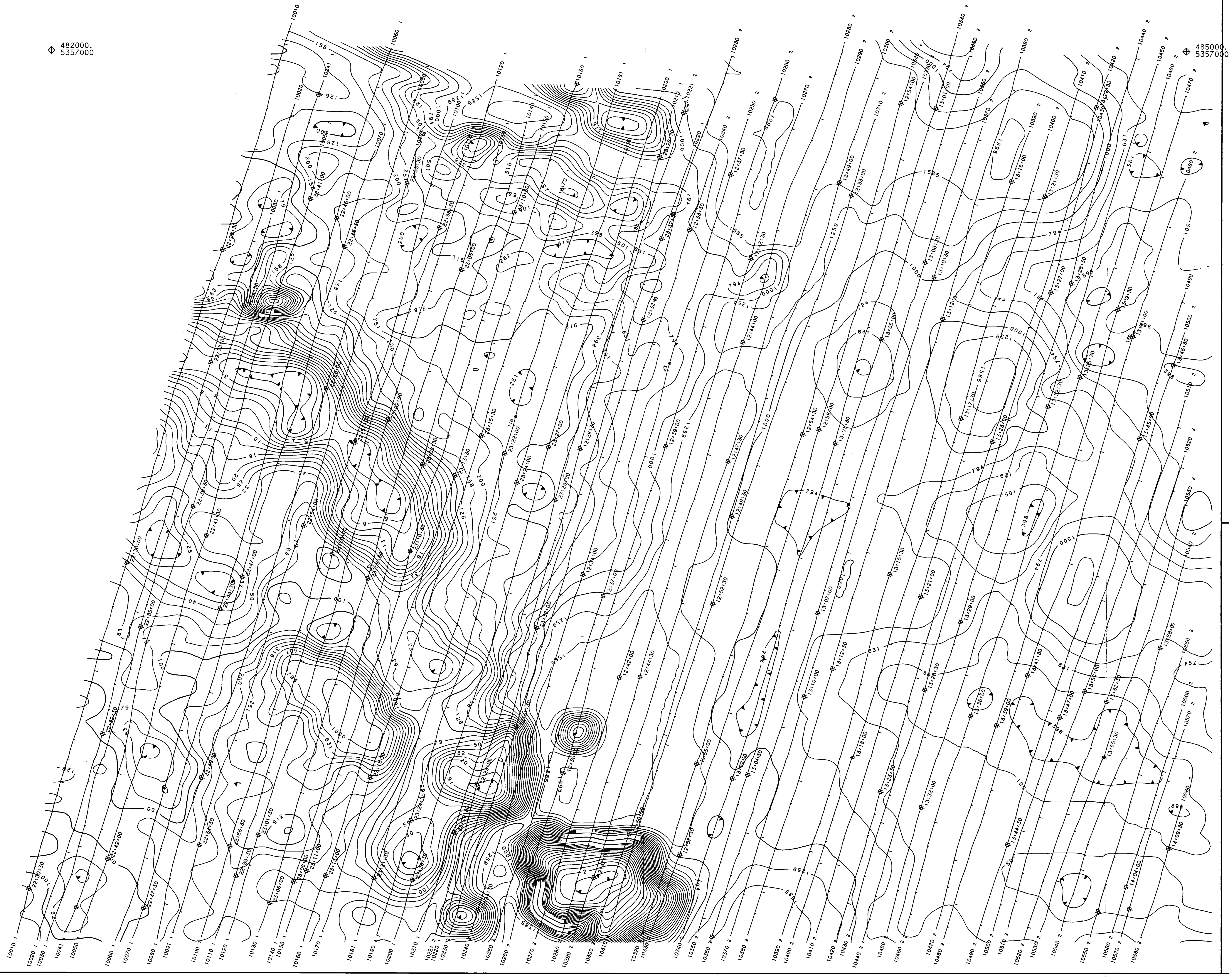
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 7 J9625- 1



Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 2739 Hz coplanar EM response assuming a 200 m conductive layer.

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

- 0.1 log(ohm*m)
- 0.5 log(ohm*m)
- 2.0 log(ohm*m)
- 5.00 log(ohm*m)

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (2736 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

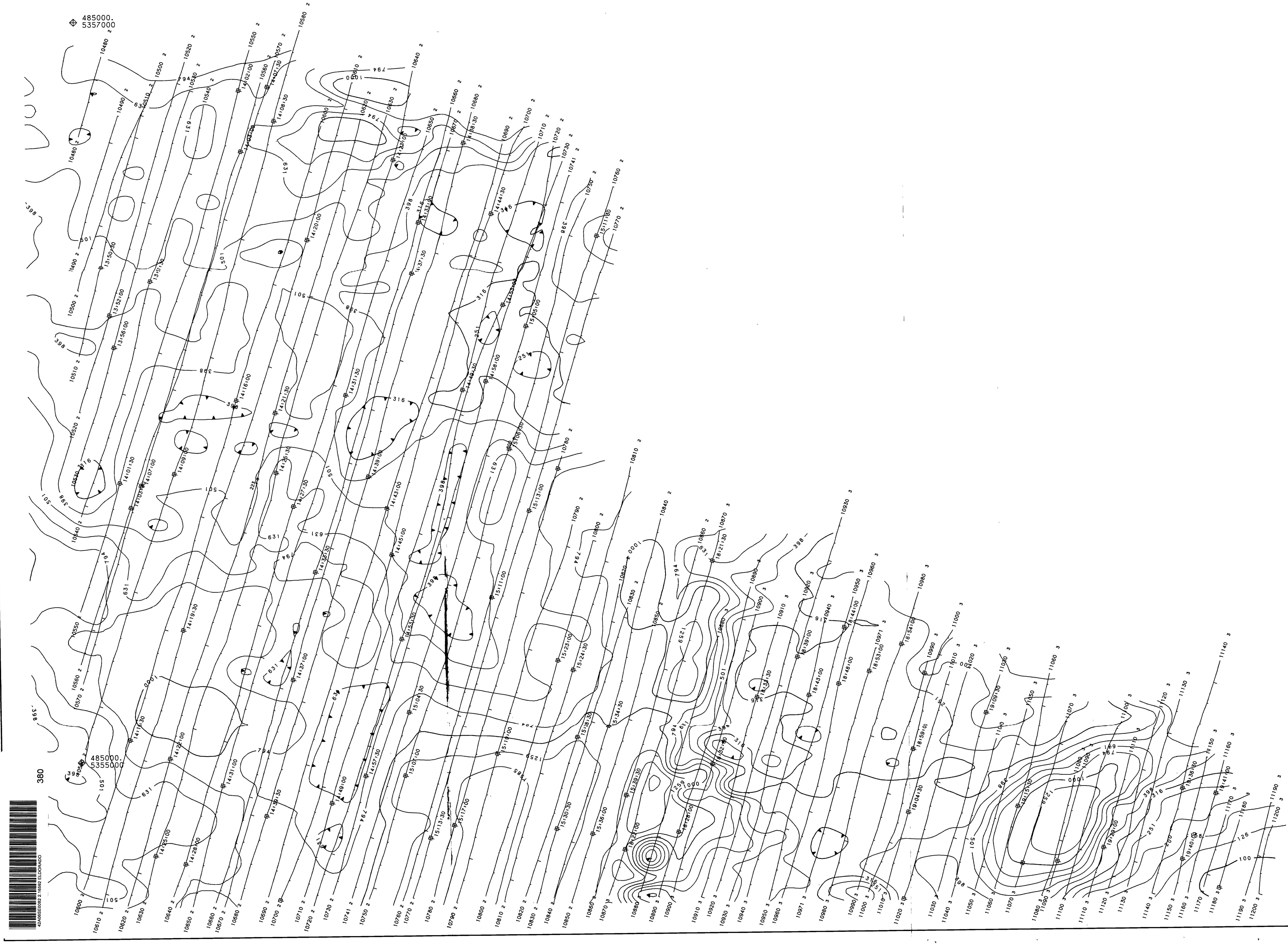
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 7 J9625- 2



380

N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 2739 Hz coplanar EM response assuming a 200 m conductive layer.

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

0.1 log(ohm*m)
0.5 log(ohm*m)
2.0 log(ohm*m)
5.00 log(ohm*m)

489000.
5357000

2.16592

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (2736 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

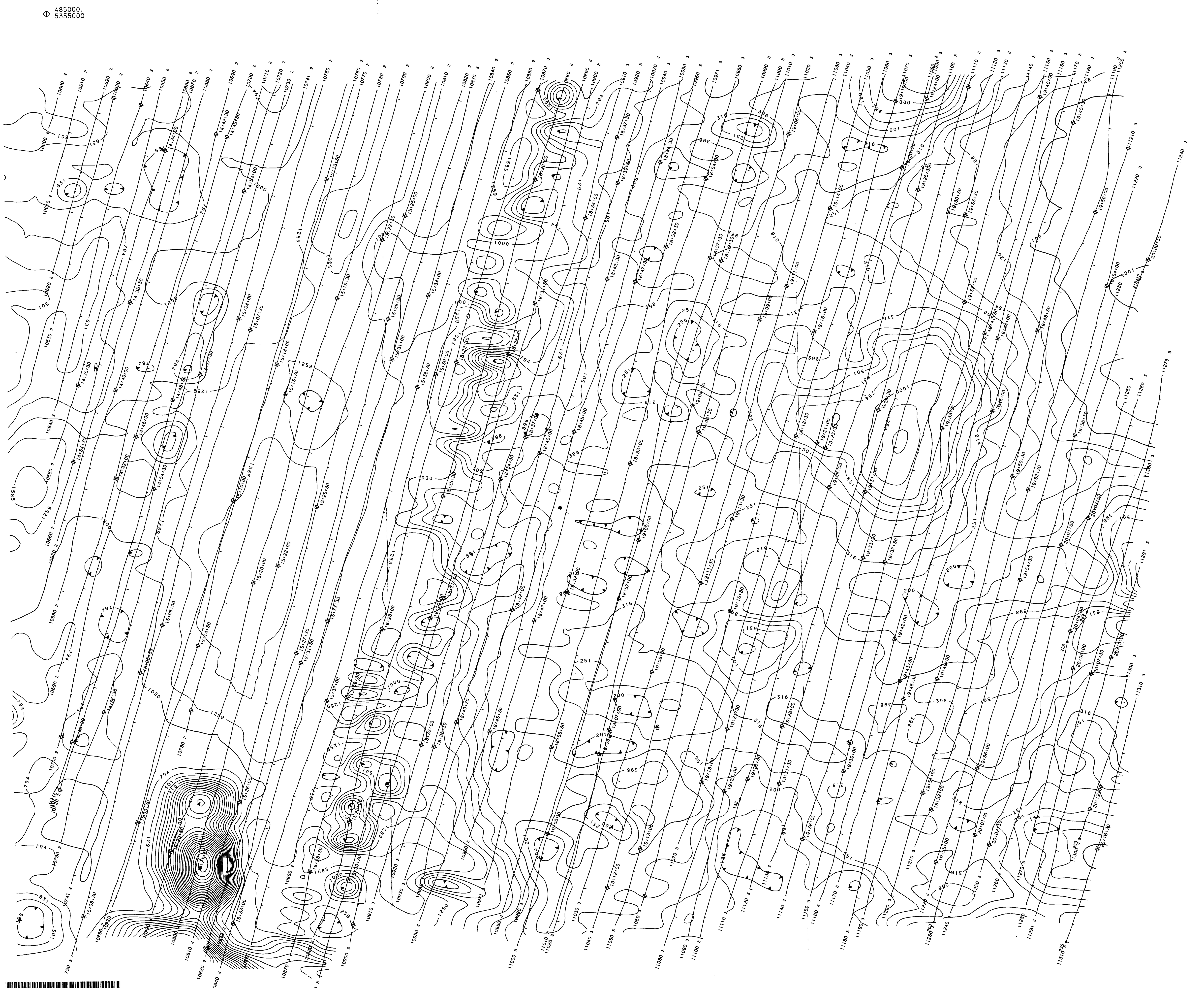
SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996
NTS No:
MAP No: 7 J9625- 3



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 2739 Hz coplanar EM response assuming a 200 m conductive layer.

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

- 0.1 log(ohm*m)
- 0.5 log(ohm*m)
- 2.0 log(ohm*m)
- 5.00 log(ohm*m)

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (2736 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

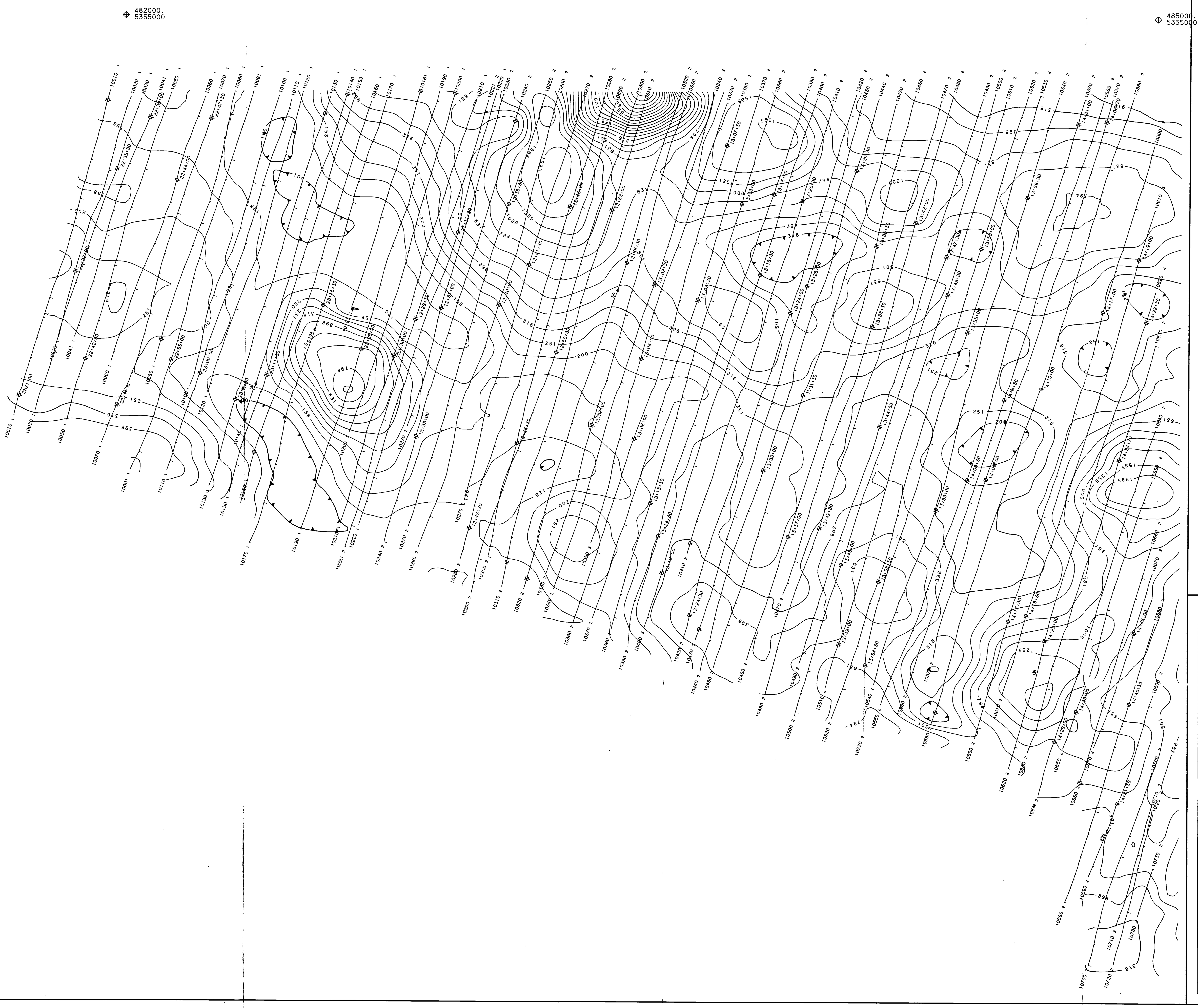
0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE:	MARCH 1996
NTS No:	
MAP No:	7 J9625- 4

390



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 32000 Hz coplanar EM response assuming a 200 m conductive layer.

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

0.1 log(ohm*m)
0.5 log(ohm*m)
2.0 log(ohm*m)
5.00 log(ohm*m)

2.16592

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (33000 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

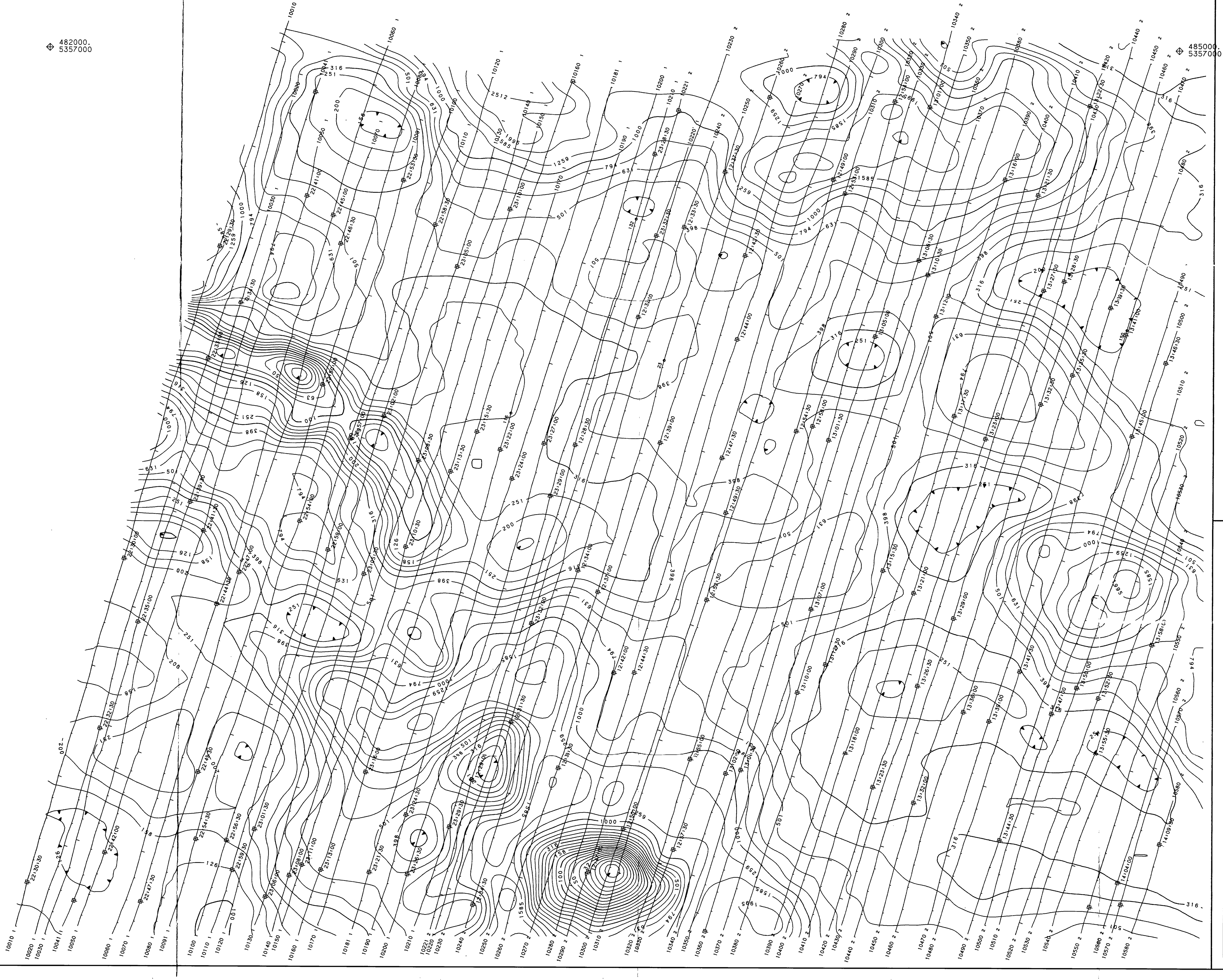
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 7 J9625- 1



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 32000 Hz coplanar EM response assuming a 200 m conductive layer.

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

0.1 log(ohm*m)
0.5 log(ohm*m)
2.0 log(ohm*m)
5.00 log(ohm*m)

2.16592

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (33000 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

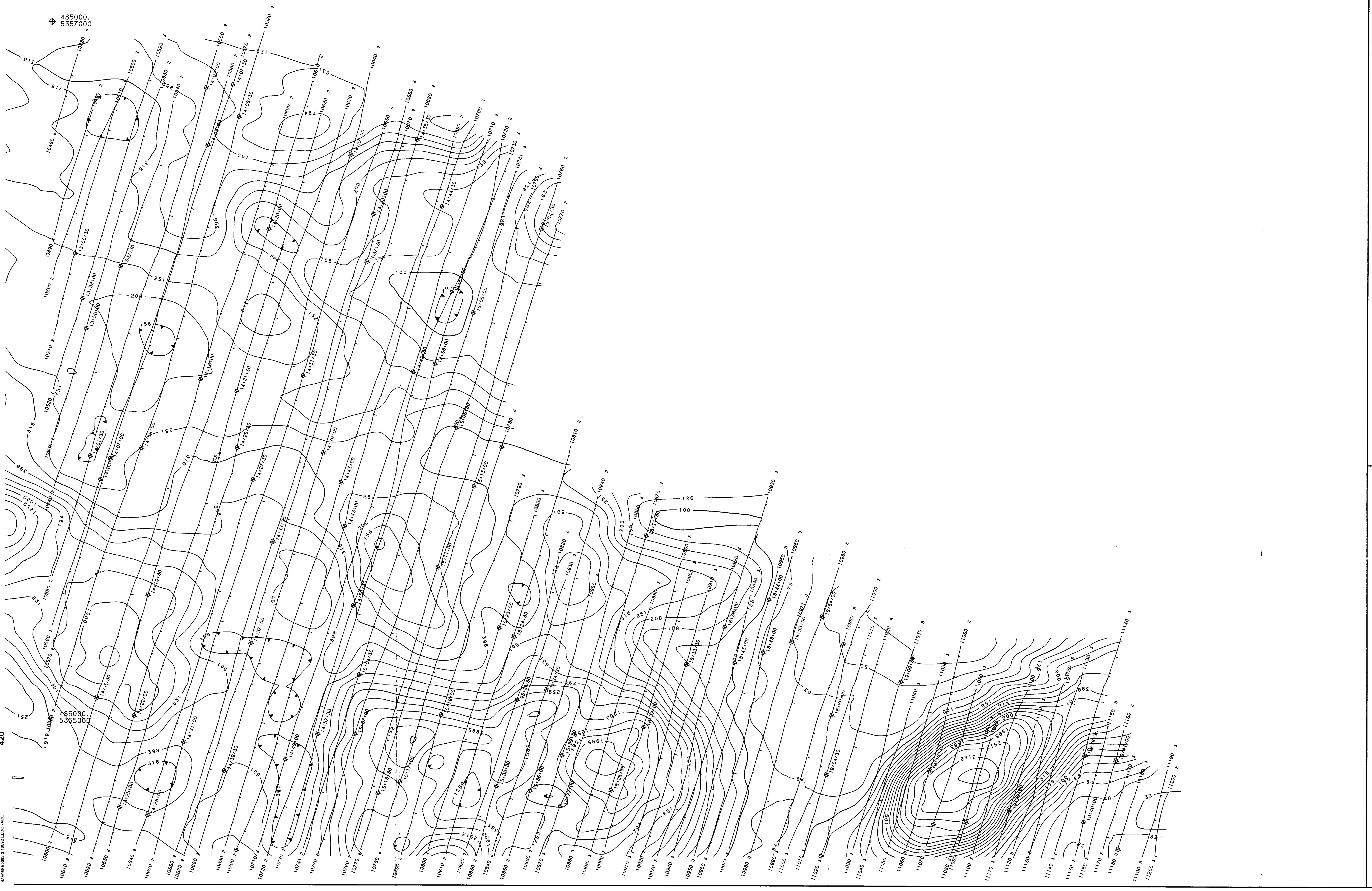
AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 7 J9625- 2

410



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 32000 Hz coplanar EM response assuming a 200 m conductive layer.

Contouring in ohm•m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

———	0.1 log(ohm•m)
———	0.5 log(ohm•m)
———	2.0 log(ohm•m)
———	5.00 log(ohm•m)

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (33000 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

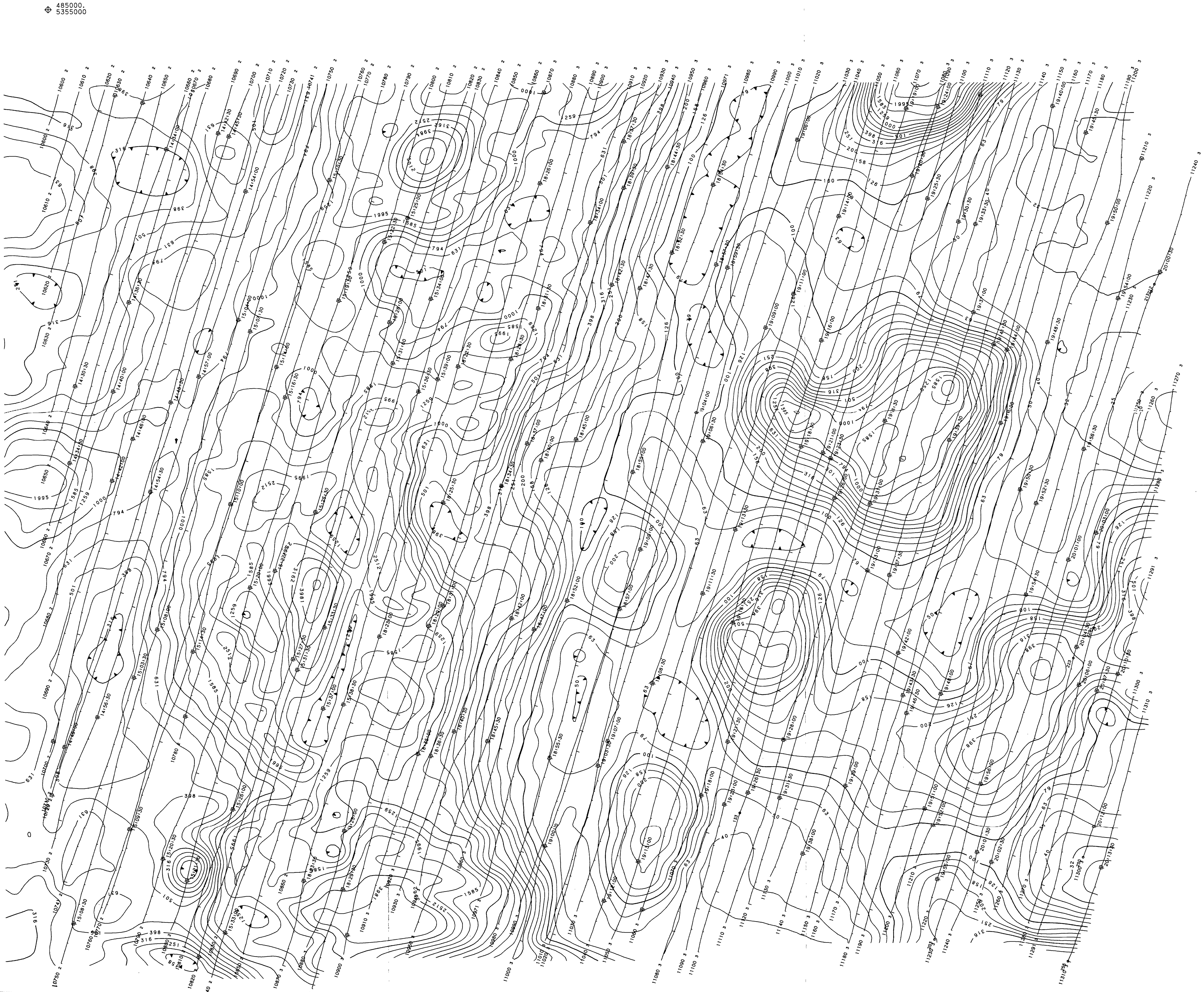
SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996
NTS No:
MAP No: 7 J9625- 3



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

Apparent Resistivity

Calculated from 32000 Hz coplanar EM response assuming a 200 m conductive layer.

489000.
5355000

Contouring in ohm*m at logarithmic intervals.

Sensor elevation 30m

Map contours are multiples of those listed below

- 0.1 log(ohm*m)
- 0.5 log(ohm*m)
- 2.0 log(ohm*m)
- 5.00 log(ohm*m)

OUTOKUMPU MINES LTD.

APPARENT RESISTIVITY CONTOURS (33000 Hz)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

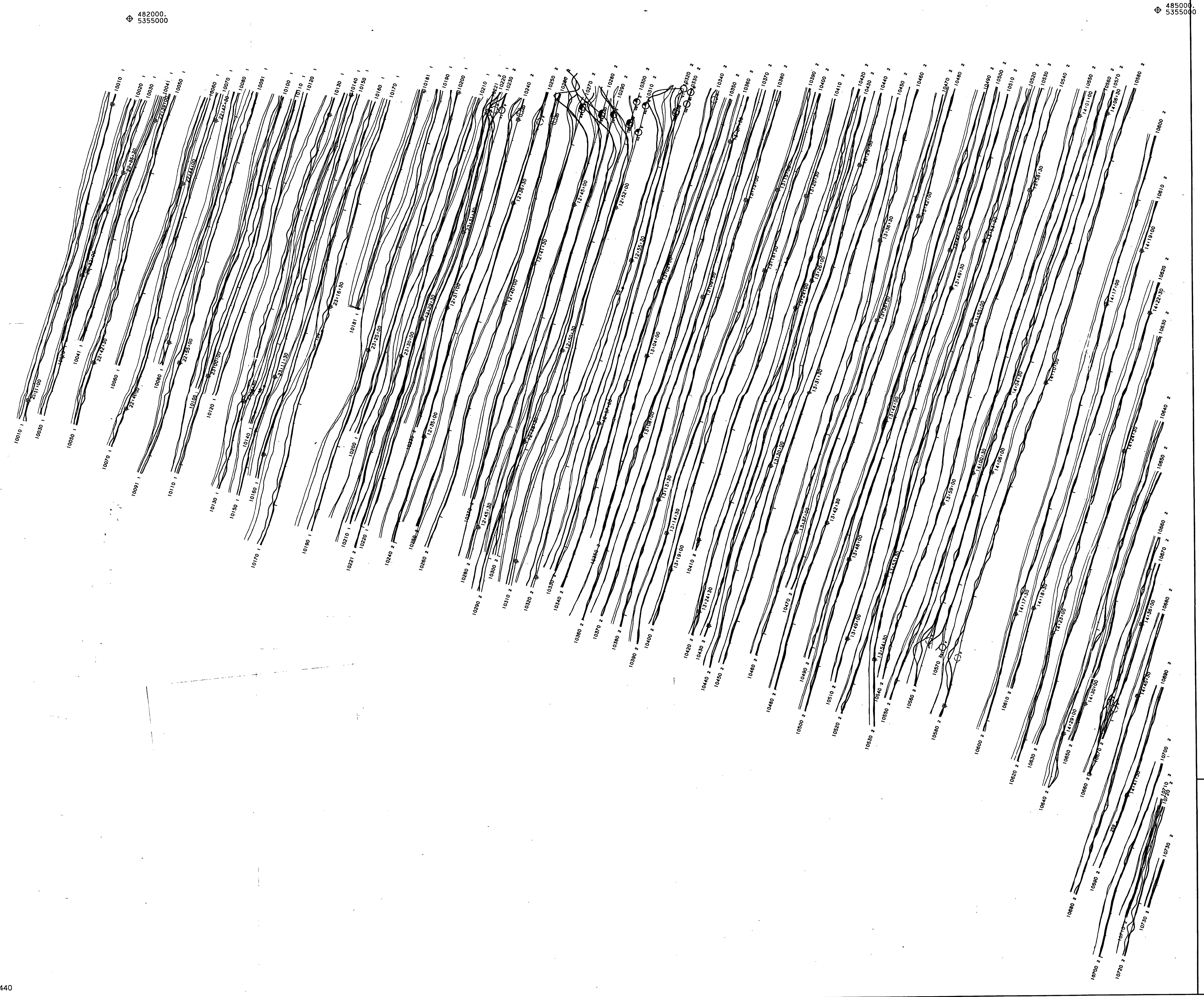
SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE:	MARCH 1996
NTS No:	
MAP No:	7 J9625- 4



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Profiles

2539 Hz Coaxial 2 ppm/mm
inphase component
quadrature component

2736 Hz Coplanar 8 ppm/mm
inphase component
quadrature component

33000 Hz Coplanar 16 ppm/mm
inphase component
quadrature component

Sensor elevation..........30m
Coil separation............7m

EM Anomalies

Conductivity Thickness (mhos)

0 - 1
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
> 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

2.16592

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (2539 Hz Coaxial/2736 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

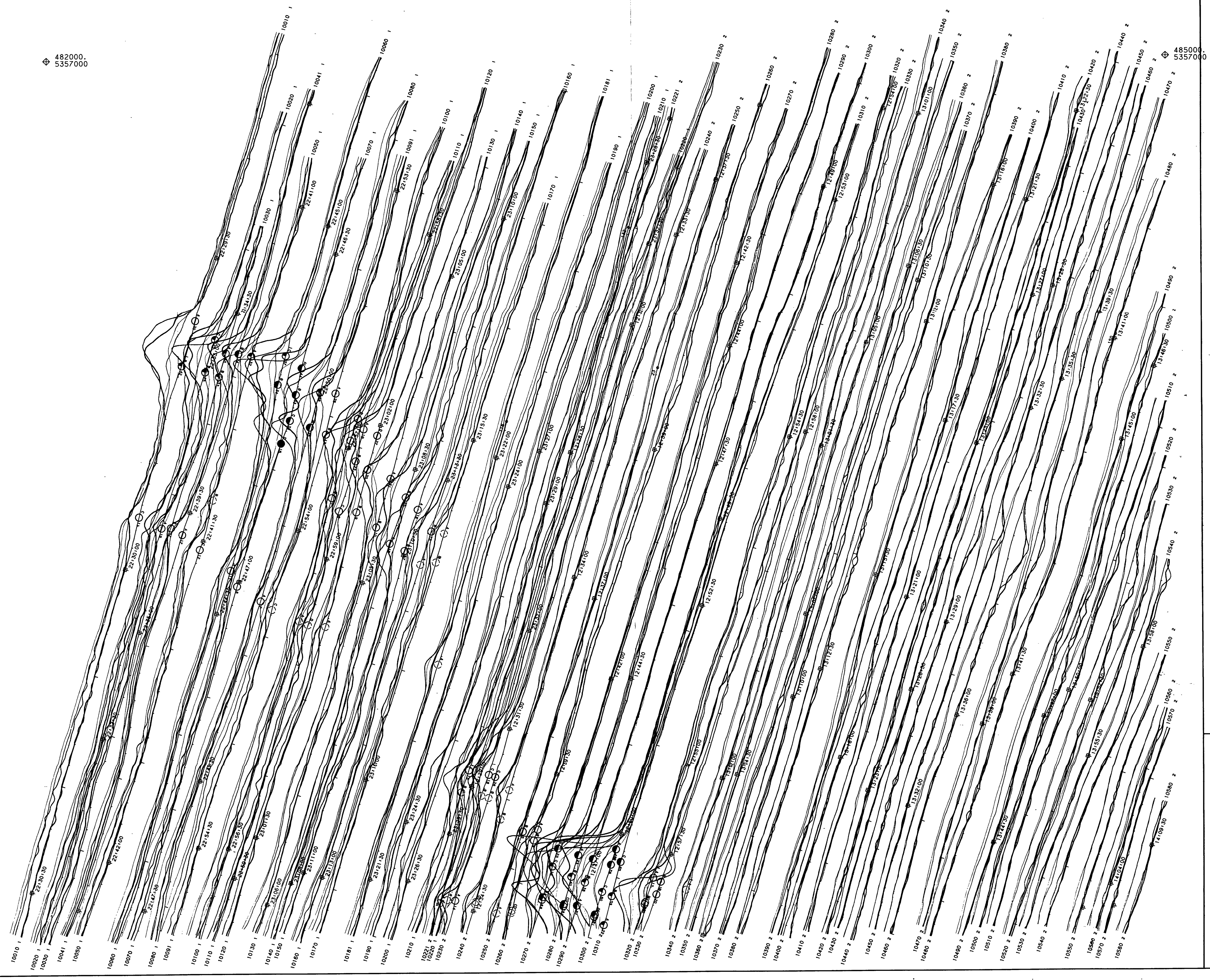
AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 8 J9625- 1

440



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Profiles

2539 Hz Coaxial 2 ppm/mm
inphase component
quadrature component

2736 Hz Coplanar 8 ppm/mm
inphase component
quadrature component

33000 Hz Coplanar 16 ppm/mm
inphase component
quadrature component

Sensor elevation..........30m
Coil separation............7m

EM Anomalies

Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 16
- 16 - 32
- > 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

2.16592

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (2539 Hz Coaxial/2736 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

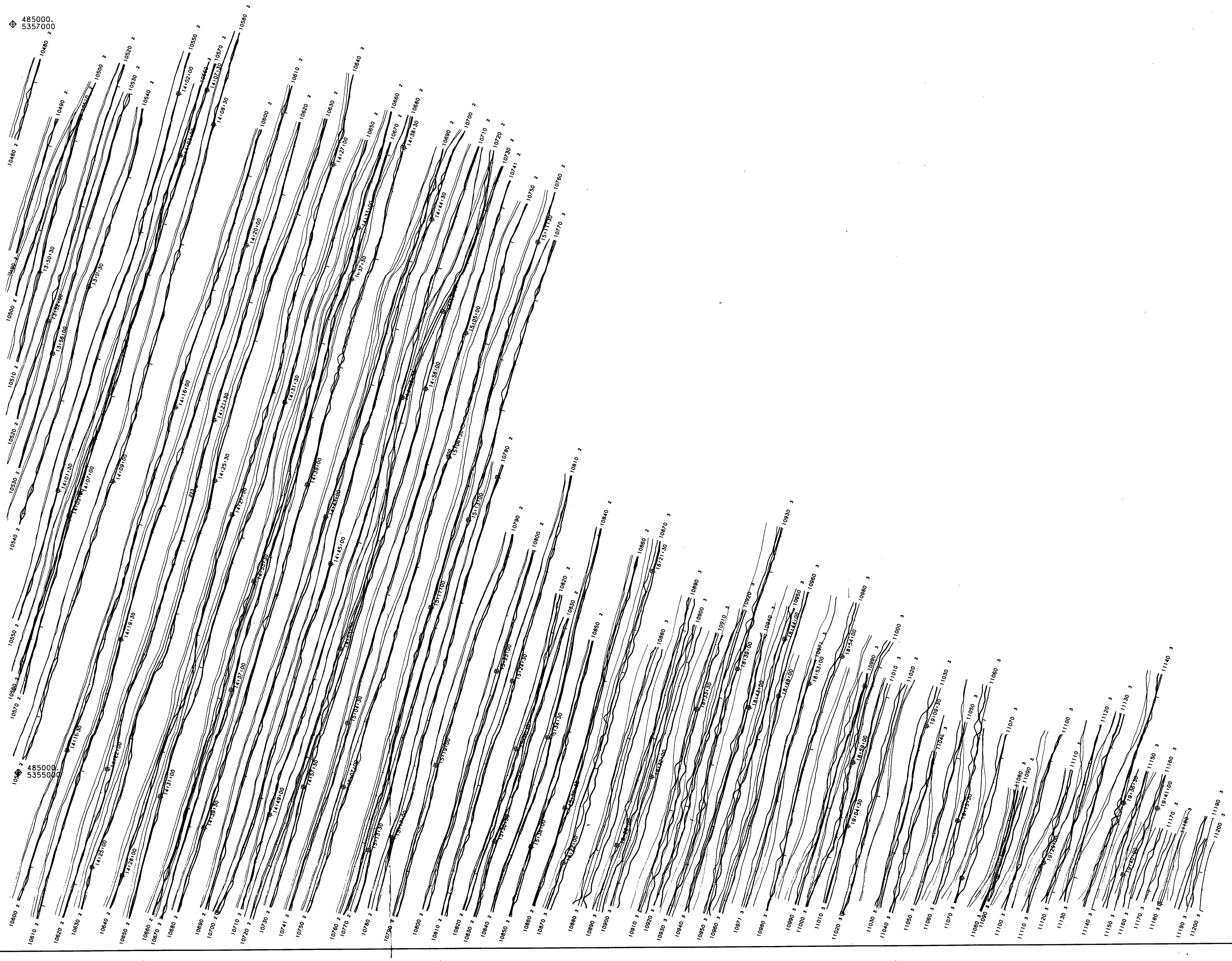
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 8 J9625- 2



Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Profiles

2539 Hz Coaxial 2 ppm/mm
inphase component
quadrature component

2736 Hz Coplanar 8 ppm/mm
inphase component
quadrature component

33000 Hz Coplanar 16 ppm/mm
inphase component
quadrature component

Sensor elevation..........30m
Coil separation............7m

EM Anomalies

489000.
5357000

Conductivity Thickness (mhos)

0 - 1
1 - 2
2 - 4
4 - 8
8 - 16
16 - 32
> 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

2.16592

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (2539 Hz Coaxial/2736 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

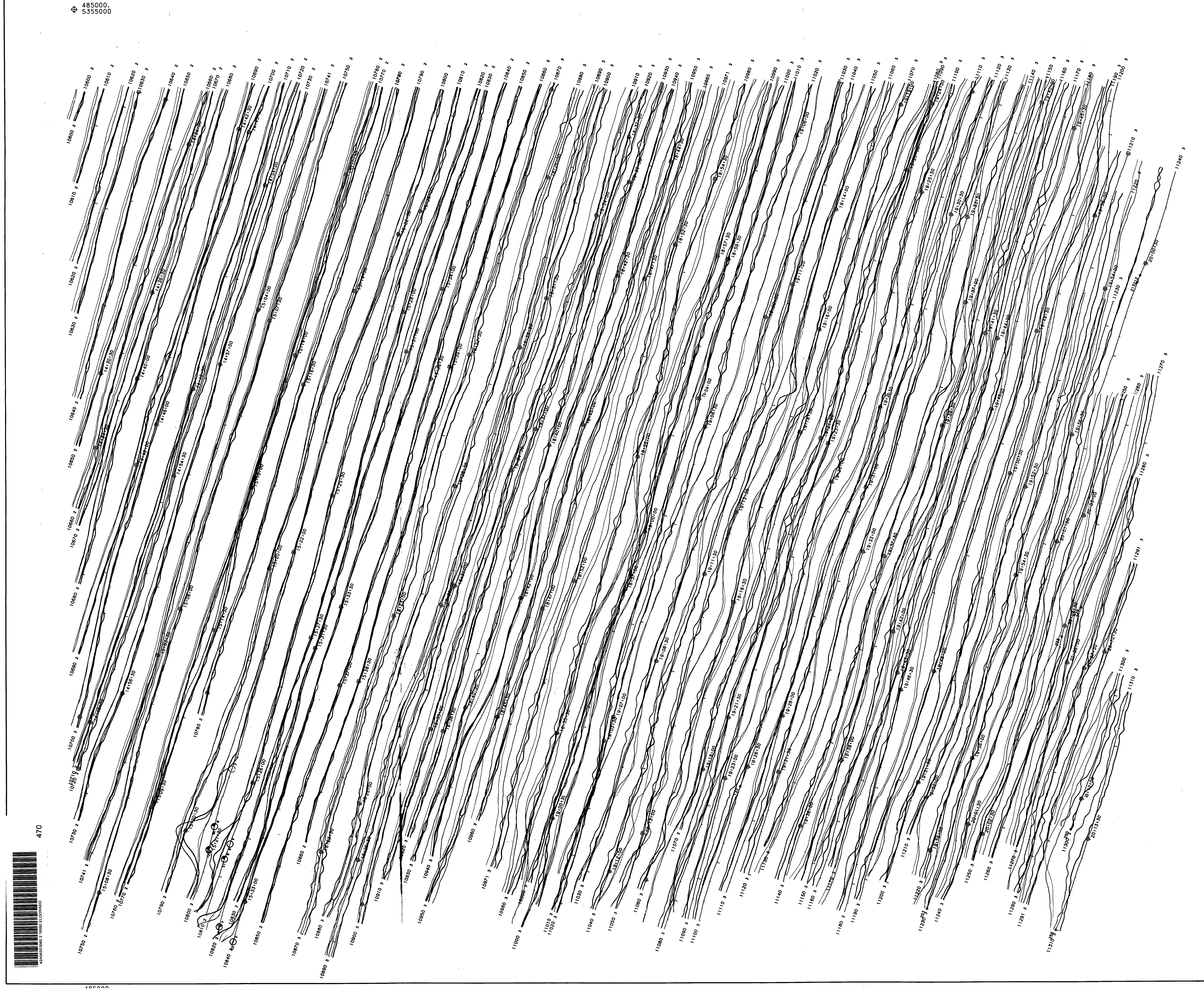
0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 8 J9625- 3



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Profiles

2539 Hz Coaxial 2 ppm/mm
inphase component
quadrature component

2736 Hz Coplanar 8 ppm/mm
inphase component
quadrature component

33000 Hz Coplanar 16 ppm/mm
inphase component
quadrature component

Sensor elevation..........30m
Coil separation............7m

EM Anomalies

Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 16
- 16 - 32
- > 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (2539 Hz Coaxial/2736 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

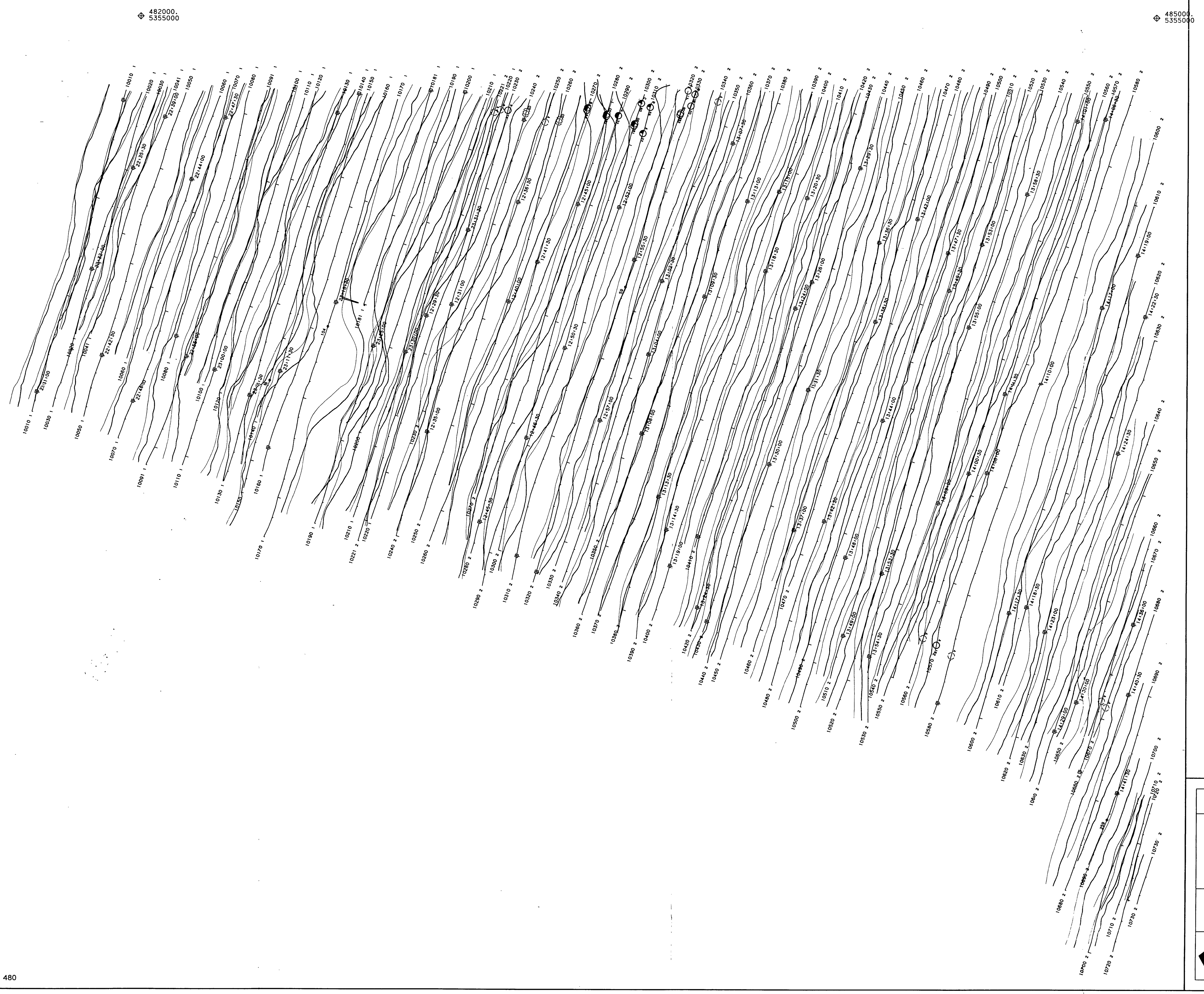
SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996
NTS No:
MAP No: 8 J9625- 4



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Profiles

2539 Hz Coaxial 2 ppm/mm
inphase component
quadrature component

2736 Hz Coplanar 8 ppm/mm
inphase component
quadrature component

33000 Hz Coplanar 16 ppm/mm
inphase component
quadrature component

Sensor elevation..........30m
Coil separation............7m

EM Anomalies

Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 16
- 16 - 32
- > 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (33000 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

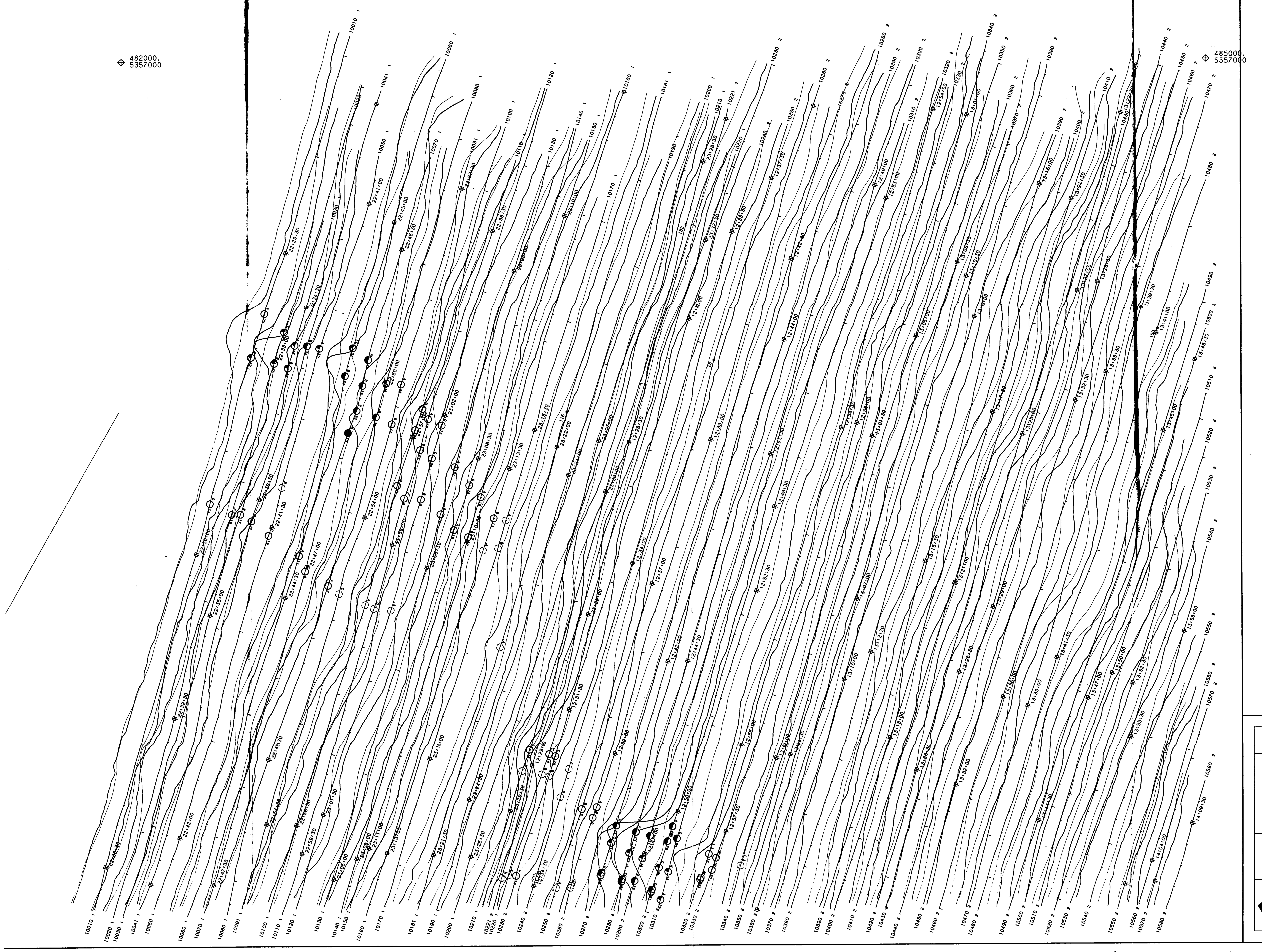
AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 8 J9625- 1

480



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.
Average terrain clearance 60m
Average line spacing 50m

EM Anomalies

Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 16
- 16 - 32
- > 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

2.16592

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (33000 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

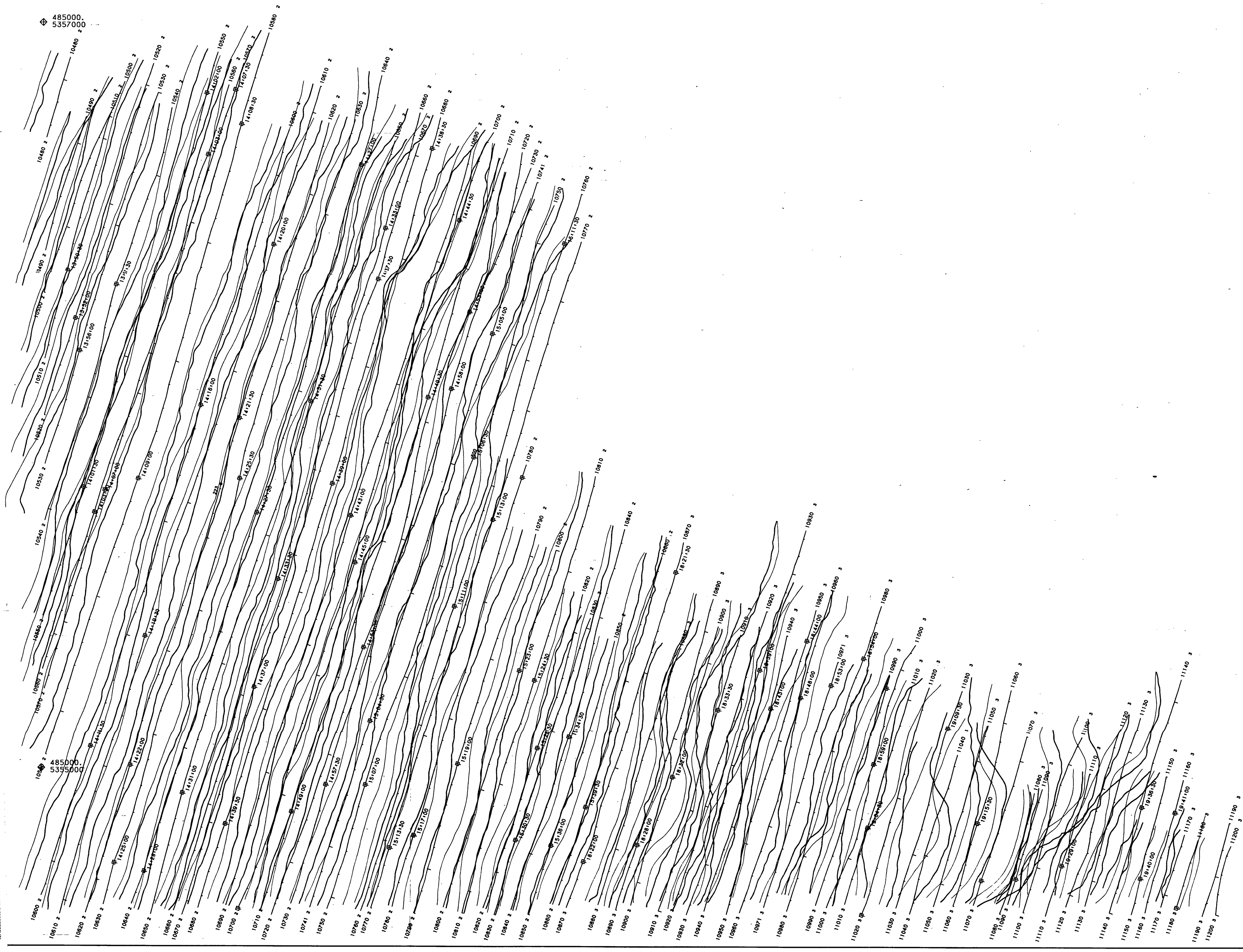
0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE:	MARCH 1996
NTS No:	
MAP No:	8 J9625- 2

490



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Profiles

2539 Hz Coaxial 2 ppm/mm
inphase component
quadrature component

2736 Hz Coplanar 8 ppm/mm
inphase component
quadrature component

33000 Hz Coplanar 16 ppm/mm
inphase component
quadrature component

Sensor elevation..........30m
Coil separation...........7m

EM Anomalies

489000
5357000

Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 16
- 16 - 32
- > 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

2.16592

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (33000 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

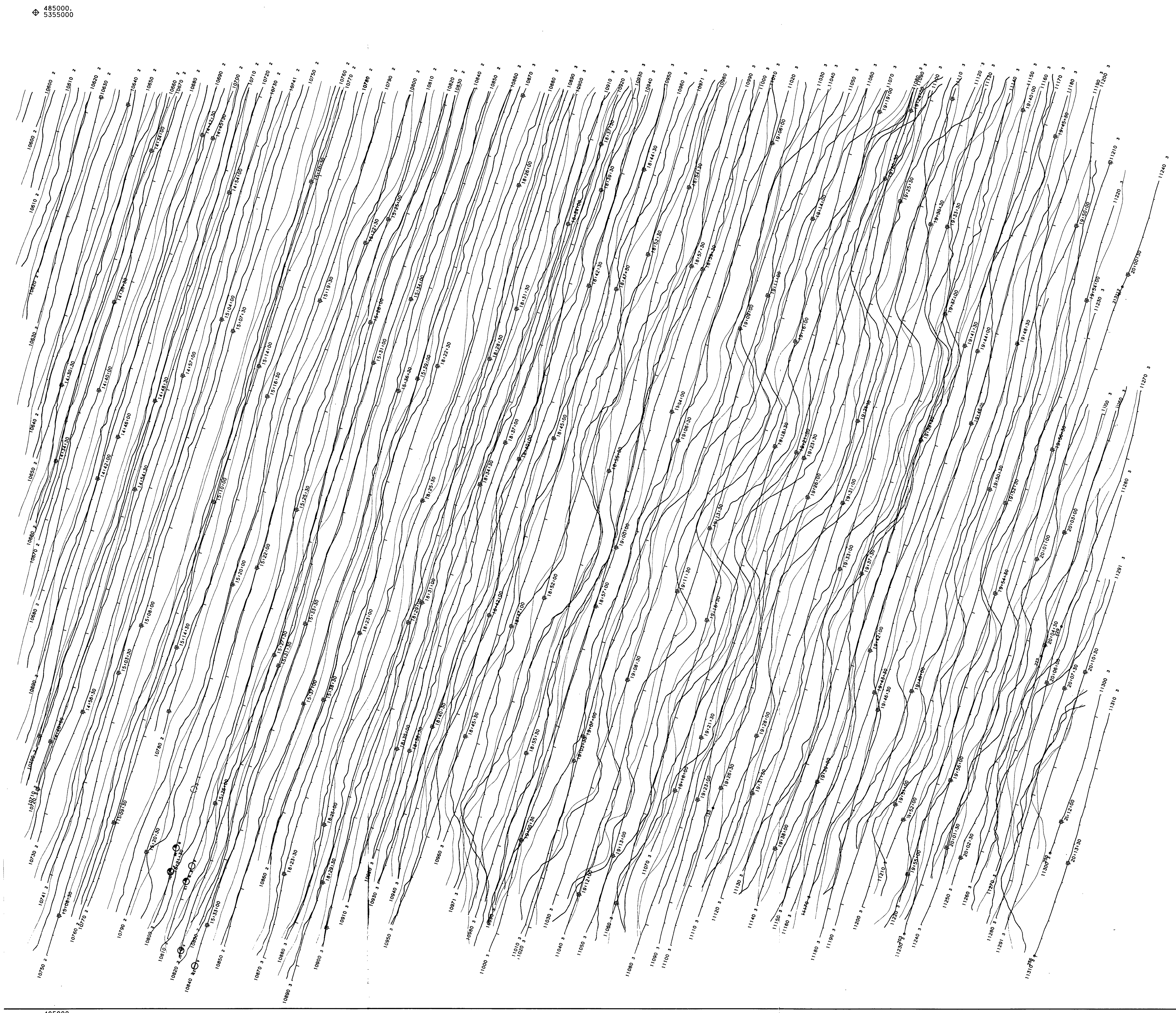
0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996
NTS No:
MAP No: 8 J9625- 3

500



N

Flight Path

Navigation and recovery using a Global Positioning (GPS) navigation system.

Average terrain clearance 60m
Average line spacing 50m

EM Profiles

2539 Hz Coaxial 2 ppm/mm
inphase component
quadrature component

2736 Hz Coplanar 8 ppm/mm
inphase component
quadrature component

33000 Hz Coplanar 16 ppm/mm
inphase component
quadrature component

Sensor elevation..........30m
Coil separation............7m

EM Anomalies

Conductivity Thickness (mhos)

- 0 - 1
- 1 - 2
- 2 - 4
- 4 - 8
- 8 - 16
- 16 - 32
- > 32

EM Anomaly A, 2539 Hz Coaxial inphase amplitude 7 ppm. Conductivity thickness 1-2 mhos (see code).

2.16592

OUTOKUMPU MINES LTD.

ELECTROMAGNETIC PROFILES (33000 Hz Coplanar)

AREA A, GRID #2

ADAMS, DELORO, ELDORADO, LANGMUIR, CARMAN AND SHAW TOWNSHIPS, NORTHERN ONTARIO

SCALE 1:5,000

0 165 330 660 1320 Feet

0 50 100 250 500 Metres

AERODAT INC.

DATE: MARCH 1996

NTS No:

MAP No: 8 J9625- 4