41015SW0055 2.7178 DENYES

010

REPORT ON
COMBINED HELICOPTER BORNE
MAGNETIC, ELECTROMAGNETIC AND VLF
SURVEY
SWAYZE AREA, ONTARIO
TOOMS, HALCROW, DENYES AND GREENLAW TOWNSHIPS
PORCUPINE MINING DIVISION

RECEIVED

SEP 14 1984

MINING LANDS SECTION

for

COLLINGWOOD ENERGY INC.

by

AERODAT LIMITED

JUNE, 1984

Project 5411

41015SW0055 2.7178 DENYES

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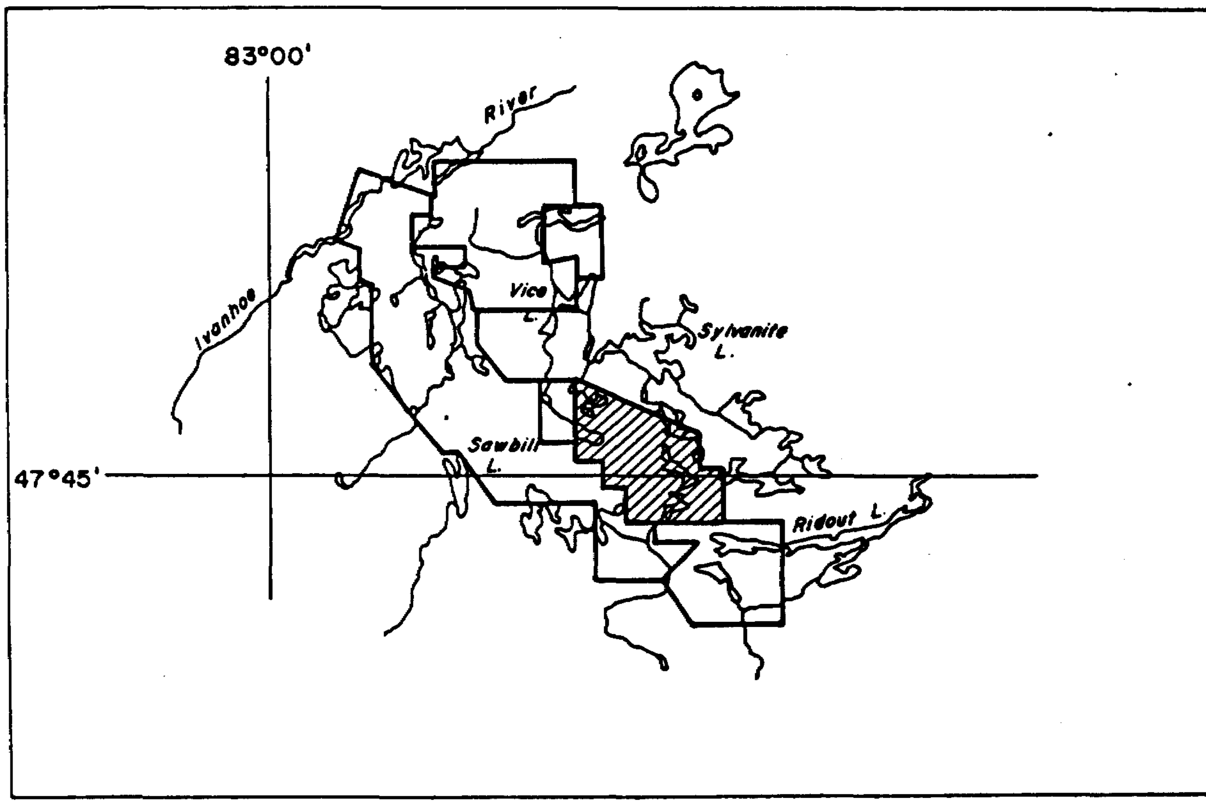
1. INTRODUCTION

This report describes an airborne geophysical survey carried out by Aerodat Limited. Equipment operated included a 3-frequency electromagnetic system, a magnetometer, a VLF-EM system, and a radar positioning system.

The survey, located near Chapleau, Ontario, was flown from March 31 to April 3, 1984. A total of approximately 925 line kilometers (575 line miles) of data were collected. This report refers to a part of this survey, consisting of 70.20 line miles.

2. SURVEY AREA LOCATION

The index map below outlines the total survey block; the shaded zone is the area relating to this report. The nominal line spacing was 100 meters.



3. AIRCRAFT AND EQUIPMENT

3.1 Aircraft

The helicopter used for the survey was an Aerospatiale A-Star 350D owned and operated by Maple Leaf Helicopters. Installation of the geophysical and ancillary equipment was carried out by Aerodat. The survey aircraft was flown at a nominal altitude of 60 meters.

3.2 Equipment

3.2.1 Electromagnetic System

The electromagnetic system was an Aerodat 3 frequency system. Two vertical coaxial coil pairs were operated at 946 and 4575 Hz and a horizontal coplanar coil pair at 4175 Hz. The transmitter-receiver separation was 7 meters. In-phase and quadrature signals were measured simultaneously for the 3 frequencies with a time-constant of 0.1 seconds. The electromagnetic bird was towed 30 meters below the helicopter.

3.2.2 VLF-EM System

The VLF-EM System was a Herz 1A. This instrument measures the total field and vertical quadrature component of the selected frequency. The sensor was towed in a bird 13.7 meters below the helicopter. The station used was NAA (Cutler, Maine, 24.0 kHz).

3.2.3 Magnetometer

The magnetometer was a Geometrics G-803 proton precession type. The sensitivity of the instrument was 1 gamma at a 0.5 second sample rate. The sensor was towed in a bird 13.7 meters below the helicopter.

3.2.4 Magnetic Base Station

An IFG proton precession type magnetometer was operated at the base of operations to record diurnal variations of the earth's magnetic field. The clock of the base station was synchronized with that of the airborne system.

3.2.5 Radar Altimeter

A Hoffman HRA-100 radar altimeter was used to record terrain clearance. The output from the instrument is a linear function of altitude for maximum accuracy.

3.2.6 Tracking Camera

A geocam tracking camera was used to record flight path on 35 mm film. The camera was operated in strip mode and the fiducial numbers for cross-reference to the analog and digital data were imprinted on the margin of the film.

3.2.7 Analog Recorder

An RMS dot-matrix recorder was used to display the data during the survey. In addition to manual and time fiducials, the following data was recorded:

Channel	Input	Scale
00	Altimeter (500 ft at top of chart)	10 ft/mm
04	high freq. quadrature	2 ppm/mm
03	high freq. in-phase	2 ppm/mm
06	mid freq. quadrature	4 ppm/mm
05	mid freq. in-phase	4 ppm/mm
02	low freq. quadrature	2 ppm/mm
01	low freq. in-phase	2 ppm/mm
15	magnetometer	25 gamma/mm
14	magnetometer	2.5 gamma/mm
07	VLF-EM Total Field	2.5%/mm
08	VLF-EM Quadrature	2.5%/mm

3.2.8 Digital Recorder

A Perle DAC/NAV data system recorded the survey data on magnetic tape. Information recorded was as follows:

Equipment	Interval
EM	0.1 second
VLF-EM	0.5 second
magnetometer	0.5 second
altimeter	1.0 second
fiducial (time)	1.0 second
fiducial (manual)	0.2 second
MRS III	0.2 second

3.2.9 Radar Positioning System

A Motorola Mini-Ranger (MRS III) radar navigation system was utilized for both navigation and track recovery. Transponders located at fixed known locations were interrogated several times per second and the ranges from these points to the helicopter measured to several meter accuracy. A navigational computer triangulates the position of the helicopter and provides the pilot with navigation information. The range/range data was recorded on magnetic tape for subsequent flight path determination.

4. DATA PRESENTATION

4.1 Base Map and Flight Path Recovery

The base map is a photomosaic at a scale of 1:10,000.

The flight path was derived from the Mini Ranger radar positioning system. The distance from the helicopter to two established reference locations was measured several times per second, and the position of the helicopter mathematically calculated by triangulation. It is estimated that the flight path is generally accurate to about 10 meters with respect to the topographic detail of the base map. The flight path is presented with fiducials for cross-reference to both the analog and digital data.

4.2 Electromagnetic Profile Maps

The electromagnetic data was recorded digitally at a sample rate of 10/second with a time constant of 0.1 second. A two stage digital filtering process was carried out to reject major sferic events, and to reduce system noise. The process is outlined below.

Local atmospheric 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 a geological phenomenon. To avoid this possibility, a computer algorithm searches out and rejects the major sferic events.

The signal to noise ratio was further enhanced by the application of a low pass digital filter. It has zero phase shift which 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 permits maximum profile shape resolution.

Following the filtering processes, a base level correction was made. The correction applied is a linear function of time that ensures that the corrected amplitude of the various in-phase and quadrature components is zero when no conductive or permeable source is present. The filtered and levelled data was then presented in profile map form.

The in-phase and quadrature responses of the 946 Hz coaxial configuration were presented with flight path and electromagnetic anomaly information on the base map.

The in-phase and quadrature responses of the 4575 Hz coaxial and the 4175 Hz coplanar coil configurations were presented as a two colour overlay.

4.3 Total Field Magnetic Contours

The aeromagnetic data was corrected for diurnal variations by subtraction of the digitally recorded base station magnetic profile. No correction for regional variation was applied.

The corrected profile data was interpolated onto a regular grid at a 25 m true scale interval using a cubic spline technique. The grid provided the basis for threading the presented contours at a 10 gamma interval.

The aeromagnetic data was presented with electromagnetic anomaly information on the base map.

4.4 VLF-EM Total Field Contours

The VLF-EM signal, from NAA (Cutler, Maine), was compiled in map form. The mean response level of the total field signal was removed and the data was gridded and contoured at an interval of 2%.

The VLF-EM data was presented with electromagnetic anomaly information on the base map.

5. INTERPRETATION

The Ontario Department of Mines, Geological Map # 2116 indicates the survey area to be largely covered by basic to intermediate volcanic rocks with some acid volcanic rocks noted, particularly in the northeast. Archean acid igneous rocks border the survey area to the north and west. A zone of metasedimentary rock extends in an east-west direction through the southern map sheet then continues in a NW/SE direction through the central sheet; a second more irregular unit occurs on the northern sheet. Several faults have been mapped in the area and strike in a NNW/SSE direction.

Aeromagnetics

The aeromagnetic contour map reflects the general geology as mapped but adds considerable detail. The intense magnetic activity along the southwestern margin of the survey area is the typical expression of basic volcanic rocks. Parallel to and in contact with this unit is a zone of low magnetization, typical of metasedimentary rocks. This zone of metasedimentary rocks extends through the central sheet into the southern sheet where it offsets to the north at a mapped fault. Other areas of metasedimentary rocks are suggested at the extreme SE corner of the project, the NE corner of the central sheet and the NE corner of the northern sheet.

In the NW corner of the northern sheet a sharp change in magnetic pattern is noted along an ENE/WSW trending contact. This is likely the edge of the acid igneous complex.

Scattered throughout the central part of the survey area are isolated, sometimes elongated magnetic anomalies. The stronger anomalies of several hundred or more gammas amplitude likely reflect basic volcanic rock. In some cases, the very intense features may be indicative of iron formation.

Also noted in the central region are numerous dykes striking in a N to NNW direction as well as in a NE direction. The amplitude of the associated magnetic anomalies ranges from tens to hundreds of gammas and may reflect differences in composition as well as thickness.

Other weaker, 20 to 50 gamma, anomalies are noted throughout the central area. These anomalies form a low amplitude, often irregular background and probably reflect acid volcanic rocks. As noted previously the metasedimentary rocks are also of low magnetization and a clear differentiation between the two units is difficult to make qualitatively. The magnetic lows in the central area may reflect sedimentary rocks or simply a transition to lower magnetization in acid volcanic rocks.

Electromagnetics

The HEM profile data was analysed and those responses interpreted to be of bedrock as opposed to surficial origin were identified. Many of the conductors are of low conductance, less than 2 mhos, and typical of electrolytic conduction in faults or shears or possible minor disseminated mineralization. As a result their response characteristics are most clearly noted on the higher frequency coil pairs.

The survey area is geologically favorable for both gold and base metal mineralization. Higher conductance responses of say 8 mhos or greater are an indication of electronic conduction due to significant sulphide or graphite mineralization and therefore warrant added consideration as base metal targets. This is not the case for gold mineralization where minor disseminated accessory mineralization may provide the only indirect indication of a favorable zone.

The emphasis in the electromagnetic interpretation was therefore directed at the identification of potential bedrock conductors without emphasis on conductance. Although a formal magnetic interpretation is beyond the scope of this report the conductors have been grouped on the basis of their geologic association as inferred from the magnetic data. The general categorization is as follows:

1. Conductors within a low featureless magnetic zone, interpreted to be indicative of metasedimentary rocks.

2. Conductors within a zone of low magnetic relief, interpreted to be indicative of acid to intermediate volcanic rocks.

3. Conductors within an area of strong magnetic relief, interpreted to be indicative of intermediate to basic volcanic rocks.

4. Conductor interpreted to be on a contact between volcanic and sedimentary rocks.

5. Conductor interpreted to be on a contact between different volcanic rocks.

As noted previously in the discussion of the magnetic data the distinction between metasedimentary and acid volcanic rocks is the least reliable and hence categories 1 and 2 as well as 4 and 5 may often be interchanged.

VLF-EM

The VLF-EM system is sensitive to lower conductance anomalies than the HEM system. It may map more clearly a weak conductor along a fault or shear but at the same time be more responsive to conductive overburden and lake bottom sediments.

The VLF contour maps were reviewed and conductive axes, not identified by the HEM system and interpreted to be of probable bedrock as opposed to surficial origin, have been indicated.

6. RECOMMENDATIONS

The general survey area is favorable for both gold and base metal mineralization. The airborne geophysical survey has identified numerous conductors within both metasedimentary and volcanic rocks that may indirectly indicate zones favorable to gold mineralization. Several conductors of higher conductance may also warrant investigation as potential base metal prospects.

Relative priorities for ground follow up investigation should be assigned by those most familiar with the detailed geology of the area.

Respectfully submitted,

AERODAT LIMITED

R. L. Scott Hogg, P.Eng.

RLSH/cb
Encl.

APPENDIX 1

GENERAL INTERPRETIVE CONSIDERATIONS

APPENDIX I

GENERAL INTERPRETIVE CONSIDERATIONS

Electromagnetic

The Aerodat 3 frequency system utilizes 2 different transmitter-receiver coil geometries. The traditional coaxial coil configuration is operated at 2 widely separated frequencies and the horizontal coplanar coil pair is operated at a frequency 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 conductivity and its size and shape; the "geometrical" property of the response is largely a function of the conductors 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 in-phase to quadrature ratio and a large phase shift a low ratio. This relationship is shown quantitatively for a vertical half-plane model on the accompanying phasor diagram. 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 ppm 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 table form in Appendix II and the conductance and in-phase amplitude are presented in symbolized form on the map presentation.

The conductance and depth values 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, 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.

Most overburden will have an indicated conductance of less than 2 mhos; however, more conductive clays may have an apparent conductance of say 2 to 4 mhos. Also in the low conductance range will be electrolytic conductors in faults and shears.

The higher ranges of conductance, greater than 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 sulphide or graphite bearing rocks.

Sulphide minerals with the exception of sphalerite, cinnabar and stibnite are good conductors; however, they 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 concentration in association with minor conductive sulphides, and the electromagnetic response 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, but minor accessory sulphide mineralization could 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; however, 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.

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. As the dip of the conductor decreases 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.

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. 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 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*.

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 coil pair.

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. In most cases the response of the coplanar coils closely follows that of the coaxial coils with a relative amplitude ratio 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.

*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.

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 elliptically polarized in the vicinity of electrical conductors. The Herz Totem uses three coils in the X, Y, Z configuration to measure the total field and vertical quadrature component of the polarization ellipse.

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 the 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 response is an indicator of the existence and position of a conductivity anomaly. 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.

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 amplitude of the quadrature response, as opposed to shape is function of target conductance and depth as well as the conductivity of the overburden and host rock. As the primary field travels down to the conductor through conductive material it is both attenuated and phase shifted in a negative sense. The secondary field produced by this altered field at the target also has an associated phase shift. This phase shift is positive and is larger for relatively poor conductors. This secondary field is attenuated and phase shifted in a negative sense during return travel to the surface. The net effect of these 3 phase shifts determine the phase of the secondary field sensed at the receiver.

A relatively poor conductor in resistive ground will yield a net positive phase shift. A relatively good conductor in more conductive ground will yield a net negative phase shift. A combination is possible whereby the net phase shift is zero and the response is purely in-phase with no quadrature component.

A net positive phase shift combined with the geometrical cross-over shape will lead to a positive quadrature response on the side of approach and a negative on the side of departure. A net negative phase shift would produce the reverse. A further sign reversal occurs with a 180 degree change in instrument orientation as occurs on reciprocal line headings. During digital processing of the quadrature data for map presentation this is corrected for by normalizing the sign to one of the flight line headings.

W.R. # 35

Ministry of Natural Resources
Ontario

Report of Work
(Geophysical, Geological, Geochemical and Expenditures)

W8406.354

27178

The Mi[ning Act]

41015SW0055 2.7178 DENYES 900

Type of Survey(s)	Township or Area
HELICOPTER BORNE EM AND MAGNETICS	Halcrow, Greenlaw, Denyes, Tyrrell

Claim Holder(s)	Prospector's Licence No.
COLLINGWOOD ENERGY INC	T-1438

Address: 403-595 Howe St, Vancouver, B.C. V6C 2T5

Survey Company	Date of Survey (from & to)	Total Miles of line Cut
AERODAT LTD.	31 Day / 3 Mo. / 84 Yr. – 31 Day / 8 Mo. / 84 Yr.	N/A.

Name and Address of Author (of Geo-Technical report): S. HOGG 3883 NASHUA DR., MISSISSAUGA, ONTARIO.

Credits Requested per Each Claim in Columns at right

Special Provisions	Geophysical	Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Man Days	Geophysical	Days per Claim
Complete reverse side and enter total(s) here	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

RECEIVED SEP 13 1984 MINING LANDS SECTION

PORCUPINE MINING DIVISION RECEIVED SEP - 7 1984 A.M. 7 8 9 10 11 12 1 2 3 4 5 6 P.M.

Expenditures (excludes power stripping)

Type of Work Performed

Performed on Claim(s)

RECORDED SEP 07 1984 Receipt No. L.b.

Calculation of Expenditure Days Credits

Total Expenditures				Total Days Credits
$	÷	15	=	

Instructions: Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Date	Recorded Holder or Agent (Signature)
Sept 5, 1984	[signature]

Mining Claims Traversed (List in numerical sequence)

Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.	Mining Claim Prefix	Mining Claim Number	Expend. Days Cr.
P.	626707	20 E.M	P	663107	20 (E.M)
	626708	"		663108	"
	642187	"		663109	"
	642188	"		663110	"
	642189	"		663111	"
	642190	"		663118	"
	642867	"		663119	"
	642868	"		663126	"
	661596	"		663127	"
	661597	"		663128	"
	661598	"		663129	"
	661599	"		663130	"
	661600	40 (E.M) 10 (Mag)		663131	"
	661601	"		663132	"
	663098	20 (E.M.)		663133	"
	663099	"		663134	"
	663100	"		663135	"
	663101	"		688581	"
	663102	"		688582	"
	663103	"		688583	"
	663104	"		688584	"
	663105	"		688591	40 (E.M) 10 (Mag)
	663106	"		688592	"

Total number of mining claims covered by this report of work: 64

For Office Use Only		
Total Days Cr. Recorded	Date Recorded	Mining Recorder
2420	Sept. 7/84	[signature] Mining Recorder
	Date Approved as Recorded	Branch Director
	Sept 25/84	[signature]

Certification Verifying Report of Work

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

Name and Postal Address of Person Certifying: RAYMOND BELL c/o DENIS A. BELL GEOLOGICAL SERVICES INC. P.O. BOX 1250, TIMMINS, ONT P4N 7J5

Date Certified	Certified by (Signature)
Sept 5, 1984	[signature]

Ministry of Natural Resources
Ontario

Report of Work
(Geophysical, Geological, Geochemical and Expenditures)

Pg 2 of 2

#5411

The Mining Act   page 2 of 2

Instructions: – Please type or print.
– If number of mining claims traversed exceeds space on this form, attach a list.
Note: – Only days credits calculated in the "Expenditures" section may be entered in the "Expend. Days Cr." columns.
– Do not use shaded areas below.

Type of Survey(s): HELICOPTER BORNE EM AND MAGNETICS
Township or Area: HOLLOWAY, Greenlaw, Denyes, Tann
Claim Holder(s): COLLINGWOOD ENERGY INC.
Prospector's Licence No.: T-1493
Address: 402-595 Howe St, Vancouver B.C. V6C 2T5
Survey Company: AERODAT LTD.
Date of Survey (from & to): 31 Day 3 Mo. 84 Yr. – 31 Day 3 Mo. 84 Yr.
Total Miles of line Cut: N/A
Name and Address of Author (of Geo-Technical report): S. HOGG, 3883 NASHUA DR., MISSISSAUGA, ONT

Credits Requested per Each Claim in Columns at right

Special Provisions	Geophysical	Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Radiometric	
	- Other	
	Geological	
	Geochemical	-

Man Days	Geophysical	Days per Claim
Complete reverse side and enter total(s) here	- Electromagnetic	
	- Magnetometer	
	- Radiometric	
	- Other	
	Geological	
	Geochemical	

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Radiometric	

PORCUPINE MINING DIVISION
RECEIVED
SEP - 7 1984
A.M. 7,8,9,10,11,12,1,2,3,4,5,6 P.M.

Expenditures (excludes power stripping)

Type of Work Performed:

Performed on Claim(s):

Calculation of Expenditure Days Credits

Total Expenditures $ [ ] ÷ 15 = Total Days Credits [ ]

Instructions
Total Days Credits may be apportioned at the claim holder's choice. Enter number of days credits per claim selected in columns at right.

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Expend. Days Cr.
P	688593	40 (EM) 10 (mag)
	688594	40 (EM) 10 (mag)
	751994	
	751995	
	751996	
	751997	
	751998	
	751999	
	752000	
	752001	
	752002	
	779863	
	779864	
	779865	
	779866	
	779867	
	779868	
	779869	

RECEIVED
SEP 13 1984
MINING LANDS SECTION

Total number of mining claims covered by this report of work: 64

For Office Use Only		
Total Days Cr. Recorded	Date Recorded	Mining Recorder
	Date Approved as Recorded	Branch Director

Date: Sept 5, 1984   Recorded Holder or Agent (Signature): [signature]

Certification Verifying Report of Work

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

Name and Postal Address of Person Certifying: RAMONE BELL c/o DAVID R. BELL GEOLOGICAL SERVICES INC. P.O. BOX 1250, TIMMINS, ONT P4N 7J5

Date Certified: Sept 5, 1984   Certified by (Signature): [signature]

1362 (81/9)

File ____________

Ontario

Ministry of Natural Resources

GEOPHYSICAL – GEOLOGICAL – GEOCHEMICAL TECHNICAL DATA STATEMENT

TO BE ATTACHED AS AN APPENDIX TO TECHNICAL REPORT
FACTS SHOWN HERE NEED NOT BE REPEATED IN REPORT
TECHNICAL REPORT MUST CONTAIN INTERPRETATION, CONCLUSIONS ETC.

#5411

Type of Survey(s) Helicopter Borne EM and Mag

Township or Area Halcrow, Tooms, Greenlaw, Denyes Twps.

Claim Holder(s) Collingwood Energy Inc.

Survey Company Aerodat Ltd.

Author of Report Scott Hogg

Address of Author 3883 Nashue Dr., Mississauga, Ont.

Covering Dates of Survey March 31/84 to Aug. 31, 1984
(linecutting to office)

Total Miles of Line Cut N/A

SPECIAL PROVISIONS CREDITS REQUESTED

ENTER 40 days (includes line cutting) for first survey.

ENTER 20 days for each additional survey using same grid.

	DAYS per claim
Geophysical	
–Electromagnetic	
–Magnetometer	
–Radiometric	
–Other	
Geological	
Geochemical	

AIRBORNE CREDITS (Special provision credits do not apply to airborne surveys)

Magnetometer 40 Electromagnetic 40 Radiometric ____
(enter days per claim)

DATE: Sept. 12, 1984 SIGNATURE: [signature]
Author of Report or Agent

Res. Geol. ____________ Qualifications ____________

Previous Surveys

File No.	Type	Date	Claim Holder

OFFICE USE ONLY

MINING CLAIMS TRAVERSED
List numerically

See attached list of
(prefix) (number)
claims - 2 pages

If space insufficient, attach list

TOTAL CLAIMS 64

837 (5/79)

GEOPHYSICAL TECHNICAL DATA

GROUND SURVEYS -- If more than one survey, specify data for each type of survey

Number of Stations ______ Number of Readings ______

Station interval ______ Line spacing ______

Profile scale ______

Contour interval ______

MAGNETIC

Instrument ______

Accuracy – Scale constant ______

Diurnal correction method ______

Base Station check-in interval (hours) ______

Base Station location and value ______

ELECTROMAGNETIC

Instrument ______

Coil configuration ______

Coil separation ______

Accuracy ______

Method: ☐ Fixed transmitter ☐ Shoot back ☐ In line ☐ Parallel line

Frequency ______ (specify V.L.F. station)

Parameters measured ______

GRAVITY

Instrument ______

Scale constant ______

Corrections made ______

Base station value and location ______

Elevation accuracy ______

INDUCED POLARIZATION RESISTIVITY

Instrument ______

Method ☐ Time Domain ☐ Frequency Domain

Parameters – On time ______ Frequency ______

– Off time ______ Range ______

– Delay time ______

– Integration time ______

Power ______

Electrode array ______

Electrode spacing ______

Type of electrode ______

SELF POTENTIAL

Instrument ______ Range ______

Survey Method ______

Corrections made ______

RADIOMETRIC

Instrument ______

Values measured ______

Energy windows (levels) ______

Height of instrument ______ Background Count ______

Size of detector ______

Overburden ______
(type, depth – include outcrop map)

OTHERS (SEISMIC, DRILL WELL LOGGING ETC.)

Type of survey ______

Instrument ______

Accuracy ______

Parameters measured ______

Additional information (for understanding results) ______

AIRBORNE SURVEYS

Type of survey(s) EM and Magnetics (Helicopter Borne)

Instrument(s) Aerodat 3 frequency Geonics EM/Geometrics G-803 Proton Mag
(specify for each type of survey)

Accuracy ± 1 gamma
(specify for each type of survey)

Aircraft used Aerospatiale A-star, 350D Helicopter

Sensor altitude EM 30m / Mag 46.3m

Navigation and flight path recovery method Motorola Mini Ranger (MRS III) radar positioning system/Geocam tracking camera to record flight path

Aircraft altitude 60m Line Spacing 100m

Miles flown over total area ~~70.2~~ miles 54 Over claims only ~~64~~ miles 70.2

GEOCHEMICAL SURVEY – PROCEDURE RECORD

Numbers of claims from which samples taken ____________

Total Number of Samples ____________

Type of Sample ____________
(Nature of Material)

Average Sample Weight ____________

Method of Collection ____________

Soil Horizon Sampled ____________

Horizon Development ____________

Sample Depth ____________

Terrain ____________

Drainage Development ____________

Estimated Range of Overburden Thickness ____________

SAMPLE PREPARATION
(Includes drying, screening, crushing, ashing)

Mesh size of fraction used for analysis ____________

General ____________

ANALYTICAL METHODS

Values expressed in: per cent ☐ p. p. m. ☐ p. p. b. ☐

Cu, Pb, Zn, Ni, Co, Ag, Mo, As,-(circle)

Others ____________

Field Analysis (____________ tests)

Extraction Method ____________

Analytical Method ____________

Reagents Used ____________

Field Laboratory Analysis

No. (____________ tests)

Extraction Method ____________

Analytical Method ____________

Reagents Used ____________

Commercial Laboratory (____________ tests)

Name of Laboratory ____________

Extraction Method ____________

Analytical Method ____________

Reagents Used ____________

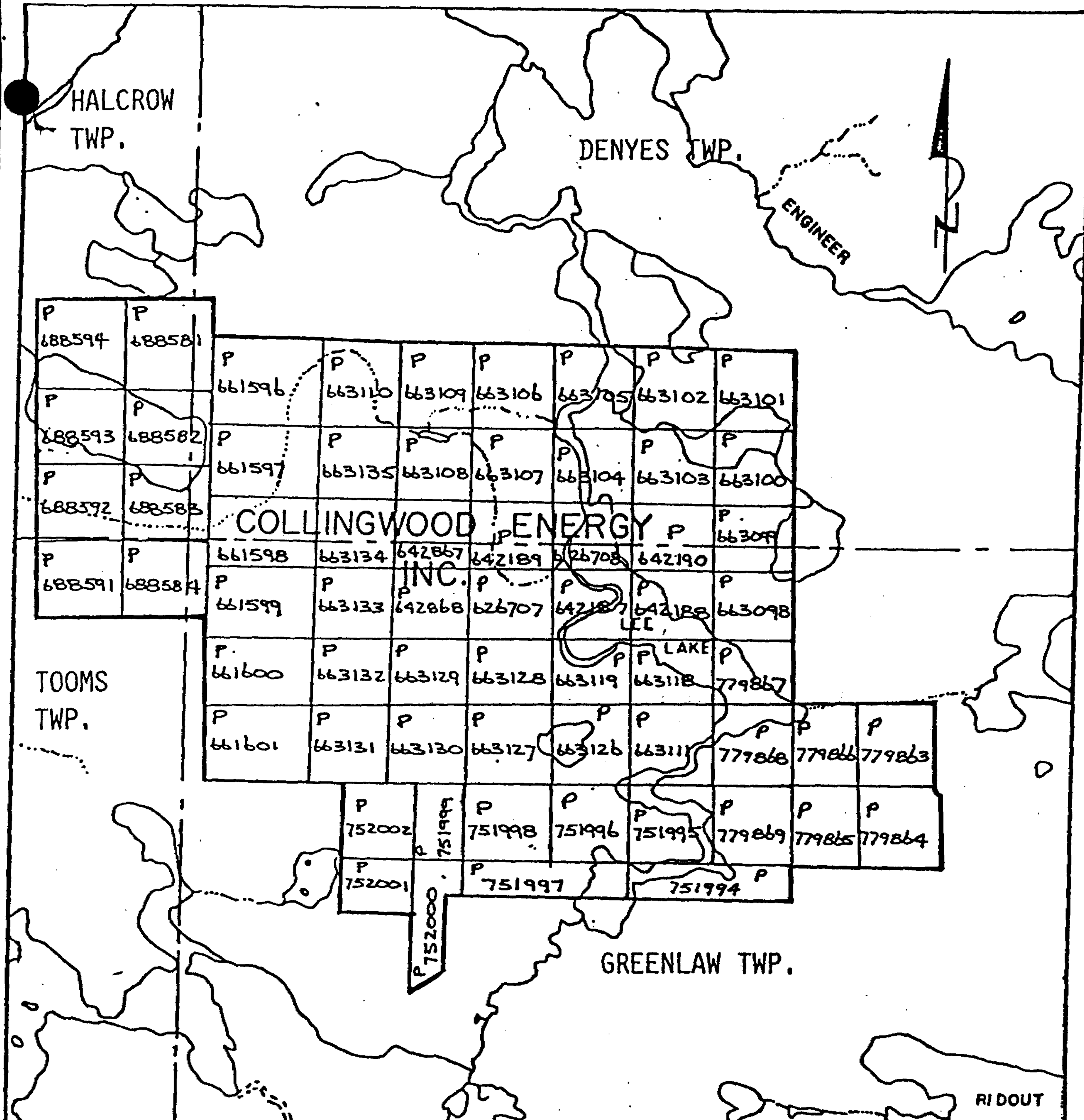
General ____________

COLLINGWOOD ENERGY INC. #5411 (SWAYZE PROJECT)
64 Claims Staked in
Greenlaw, Denyes, Tooms and Halcrow Township
Porcupine Mining Division

Claim Number	Township	Recording Date
P626707	Greenlaw	April 5, 1982
P626708	Greenlaw and Denyes	April 5, 1982
P642187	Greenlaw	April 5, 1982
P642188	Greenlaw	April 5, 1982
P642189	Greenlaw and Denyes	April 5, 1982
P642190	Greenlaw and Denyes	April 22, 1982
P642867	Greenlaw and Denyes	Sept. 29, 1982
P642868	Greenlaw	Sept. 29, 1982
P661596	Denyes	Oct. 21, 1982
P661597	Denyes	Oct. 21, 1982
P661598	Greenlaw and Denyes	Oct. 21, 1982
P661599	Greenlaw	Oct. 21, 1982
P661600	Greenlaw	Oct. 21, 1982
P661601	Greenlaw	Oct. 21, 1982
P663098	Greenlaw	Oct. 21, 1982
P663099	Greenlaw and Denyes	Oct. 21, 1982
P663100	Denyes	Oct. 21, 1982
P663101	Denyes	Oct. 21, 1982
P663102	Denyes	Oct. 21, 1982
P663103	Denyes	Oct. 21, 1982
P663104	Denyes	Oct. 21, 1982
P663105	Denyes	Oct. 21, 1982
P663106	Denyes	Oct. 21, 1982
P663107	Denyes	Oct. 21, 1982
P663108	Denyes	Oct. 21, 1982
P663109	Denyes	Oct. 21, 1982
P663110	Denyes	Oct. 21, 1982
P663111	Greenlaw	Oct. 21, 1982
P663118	Greenlaw	Oct. 21, 1982
P663119	Greenlaw	Oct. 21, 1982
P663126	Greenlaw	Oct. 21, 1982

COLLINGWOOD ENERGY INC. #5411 (SWAYZE PROJECT)
64 Claims Staked in
Greenlaw, Denyes, Tooms and Halcrow Townships
Porcupine Mining Division

Claim Number	Township	Recording Date
P663127	Greenlaw	Oct. 21, 1982
P663128	Greenlaw	Oct. 21, 1982
P663129	Greenlaw	Oct. 21, 1982
P663130	Greenlaw	Oct. 21, 1982
P663131	Greenlaw	Oct. 21, 1982
P663132	Greenlaw	Oct. 21, 1982
P663133	Greenlaw	Oct. 21, 1982
P663134	Greenlaw and Denyes	Oct. 21, 1982
P663135	Denyes	Oct. 21, 1982
P688581	Halcrow and Denyes	March 4, 1983
P688582	Halcrow and Denyes	March 4, 1983
P688583	Halcrow and Denyes	March 4, 1983
P688584	Tooms	March 4, 1983
P688591	Tooms	March 4, 1983
P688592	Halcrow	March 4, 1983
P688593	Halcrow	March 4, 1983
P688594	Halcrow	March 4, 1983
P751994	Greenlaw	Dec. 23, 1983
P751995	Greenlaw	Dec. 23, 1983
P751996	Greenlaw	Dec. 23, 1983
P751997	Greenlaw	Dec. 23, 1983
P751998	Greenlaw	Dec. 23, 1983
P751999	Greenlaw	Dec. 23, 1983
P752000	Greenlaw	Dec. 23, 1983
P752001	Greenlaw	Dec. 23, 1983
P752002	Greenlaw	Dec. 23, 1983
P779863	Greenlaw	Dec. 23, 1983
P779864	Greenlaw	Dec. 23, 1983
P779865	Greenlaw	Dec. 23, 1983
P779866	Greenlaw	Dec. 23, 1983
P779867	Greenlaw	Dec. 23, 1983
P779868	Greenlaw	Dec. 23, 1983
P779869	Greenlaw	Dec. 23, 1983



FROM: ODM Map No. M895 "Greenlaw"

Scale 1"=½ mile

DAVID R. BELL GEOLOGICAL SERVICES INC.	
COLLINGWOOD ENERGY INC.	
Claim Map Porcupine Mining Division Project #5411	
May 29, 1984	MAP 5

1984 09 21

Your File: 354
Our File:2.7178

Mining Recorder
Ministry of Natural Resources
60 Wilson Avenue
Timmins, Ontario
P4N 2S7

Dear Sir:

We have received reports and maps for an Airborne Geophysical (Electromagnetic and Magnetometer) Survey submitted on Mining Claims P 626707 et al in the Townships of Halcrow, Tooms, Greenlaw and Denyes.

This material will be examined and assessed and a statement of assessment work credits will be issued.

Yours sincerely,

S.E. Yundt
Director
Land Management Branch

Whitney Block, Room 6643
Queen's Park
Toronto, Ontario
M7A 1W3
Phone: (416)965-6918

A.Barr:sc

cc: Collingwood Energy Inc
401 - 595 Howe Street
Vancouver, B.C.
V6C 2T5

cc: David R. Bell Geological Services Inc
251 Third Avenue
Suite 14
Box 1250
Timmins, Ontario
P4N 7J5
Attn: R.A. Bell

DAVID R. BELL GEOLOGICAL SERVICES INC.

251 THIRD AVE., SUITE 14
BOX 1250
TIMMINS, ONTARIO
P4N 7J5
(705) 264-4286

REGISTERED

September 12, 1984

RECEIVED

SEP 14 1984

MINING LANDS SECTION

Mr. F. Mathews
Lands Administration Branch
Mining Lands Section
Ministry of Natural Resources
Room 6610, Whitney Block
Queen's Park
Toronto, Ontario
M7A 1W3

Dear Mr. Mathews:

Re: Collingwood Energy Inc. #5411, 64 claim property, P626707 et al
Topaz Exploration Ltd. #5424, 12 claim property, P757405 et al
J. Larche (LHB-Kelly Kerr) #5461, 9 claim property, P757430 et al
properties located in Halcrow, Tooms, Greenlaw and Denyes Twps.
(Swayze area)

Enclosed please find 2 copies of a Helicopter Borne, VLF-EM Em and Magnetics reports covering each of the above properties as per Ontario Ministry of Natural Resources requirements. The above report of work forms were filed September 5, 1984.

Please acknowledge receipt of the above reports to our office as well as each respective recorded claim holder.

Yours assistance in the above matter is appreciated.

Sincerely yours,

R.A. Bell

R.A. Bell
Vice-President

RAB/kg

Encl.

cc N. Dragovan, J. Morton, J. Larche
H. Hanson, D. Bell

File - 5411, 5424, 5461, corresp.,
claims, geophysics reports

Mining Lands Section

File No 27178

Control Sheet

TYPE OF SURVEY

✓ GEOPHYSICAL

___ GEOLOGICAL

___ GEOCHEMICAL

___ EXPENDITURE

MINING LANDS COMMENTS:

L.D.

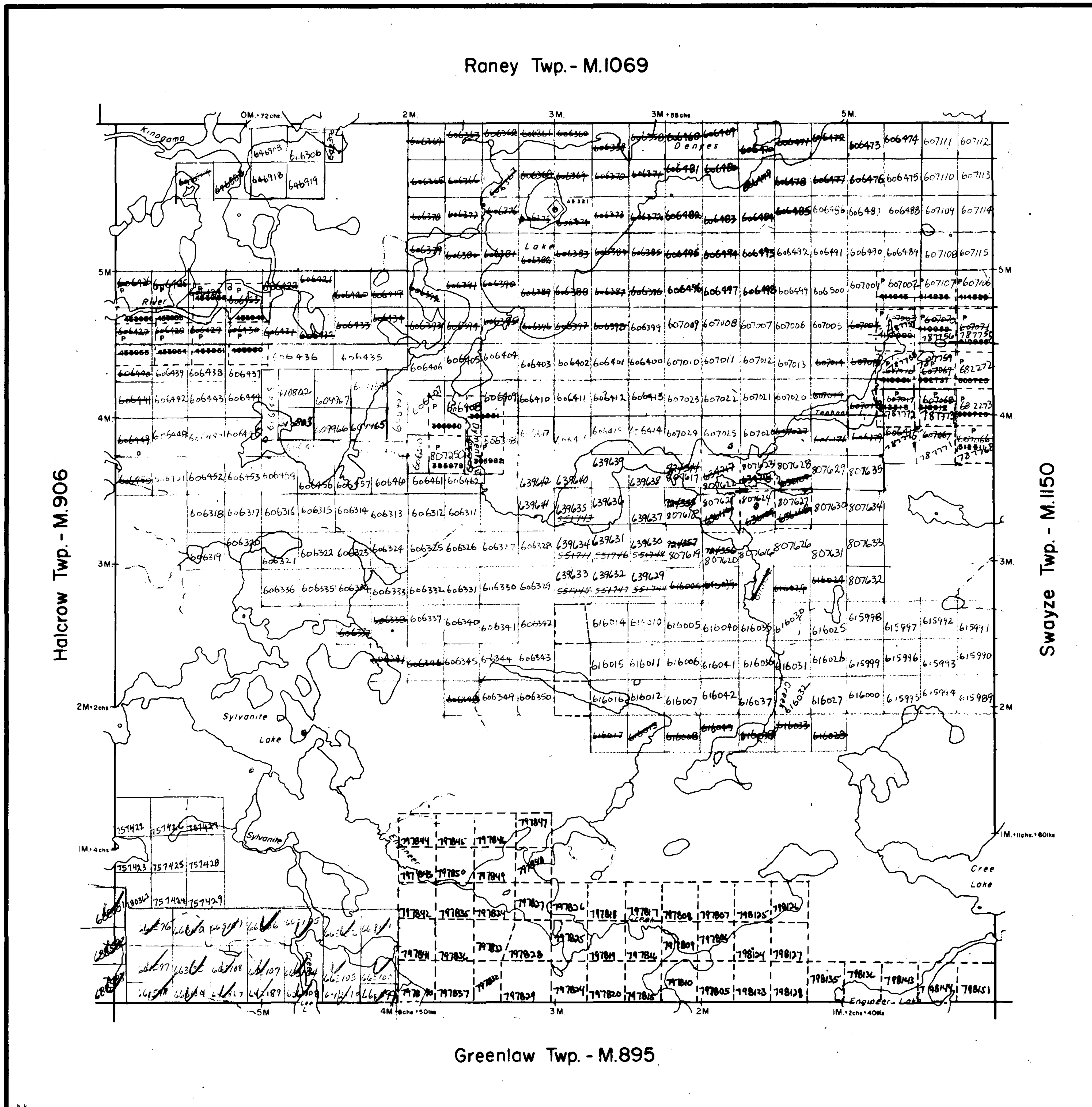
Dennis King

Signature of Assessor

Sept. 24/84

Date

TRIM LINE



THE TOWNSHIP OF

DENYES

DISTRICT OF SUDBURY

PORCUPINE MINING DIVISION

SCALE: 1-INCH = 40 CHAINS

LEGEND

PATENTED LAND	P
CROWN LAND SALE	C.S.
LEASES	L
LOCATED LAND	Loc.
LICENSE OF OCCUPATION	L.O.
MINING RIGHTS ONLY	M.R.O.
SURFACE RIGHTS ONLY	S.R.O.
ROADS	
IMPROVED ROADS	
KING'S HIGHWAYS	
RAILWAYS	
POWER LINES	
MARSH OR MUSKEG	
MINES	
CANCELLED	C.
PATENTED FOR S.R.O.	

NOTES

400' surface rights reservation along the shores of all lakes and rivers.

PLAN NO. M.758

ONTARIO
MINISTRY OF NATURAL RESOURCES
SURVEYS AND MAPPING BRANCH

M.758

DENYES TWP.

28

41O15SW0055 2.7178 DENYES

200

TRIM LINE

M.906

HALCROW TWP

January 17, 1984

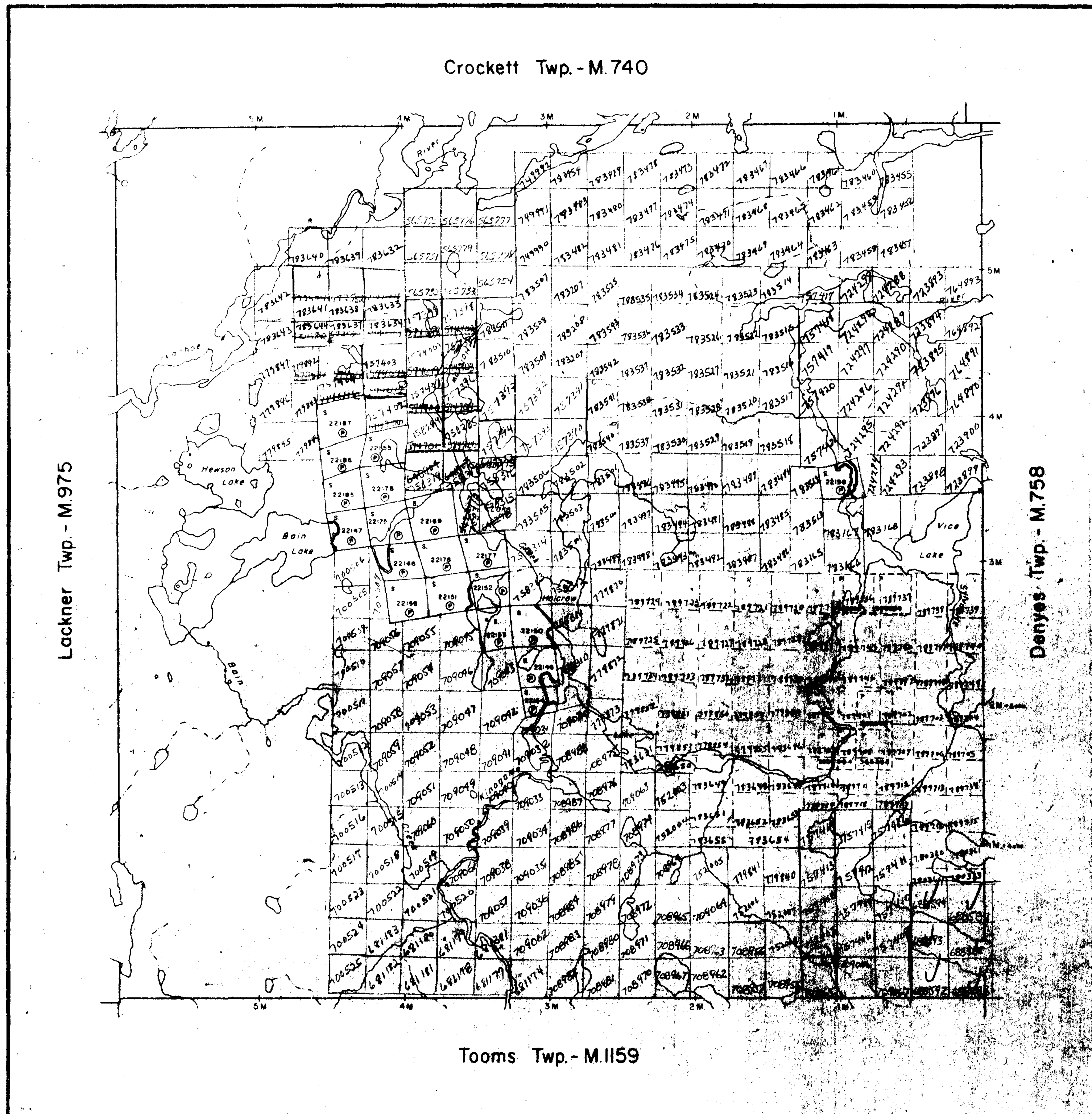
THE TOWNSHIP
OF

HALCROW

DISTRICT OF
SUDBURY

PORCUPINE
MINING DIVISION

SCALE: 1-INCH 40 CHAINS



LEGEND

PATENTED LAND	Ⓟ
CROWN LAND SALE	C.S
LEASES	Ⓛ
LOCATED LAND	Loc.
LICENSE OF OCCUPATION	L.O.
MINING RIGHTS ONLY	M.R.O.
SURFACE RIGHTS ONLY	S.R.O
ROADS	
IMPROVED ROADS	
KING'S HIGHWAYS	
RAILWAYS	
POWER LINES	
MARSH OR MUSKEG	
MINES	
CANCELLED	C.

NOTES

400' Surface Rights Reservation around all lakes and rivers.

DATE OF ISSUE
SEP 25 1984
Ministry of Natural Resources
TORONTO

PLAN NO. M.906

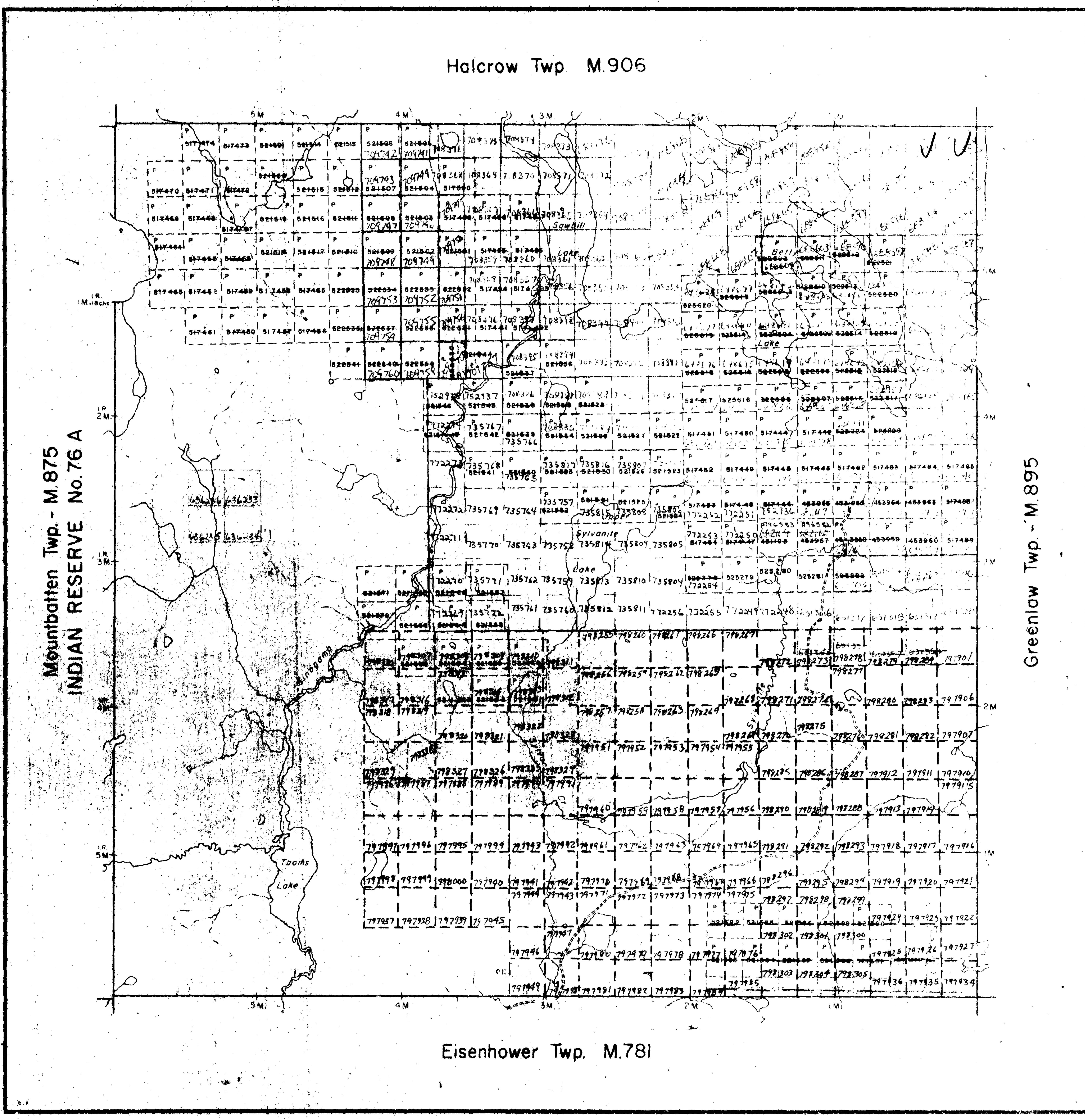
ONTARIO
MINISTRY OF NATURAL RESOURCES
SURVEYS AND MAPPING BRANCH

41015SW0055 2.7178 DENYES

210

M.1159

TOOMS TWP



THE TOWNSHIP OF

TOOMS

DISTRICT OF SUDBURY

PORCUPINE MINING DIVISION

SCALE 1-INCH = 40 CHAINS

LEGEND

PATENTED LAND	(P)
CROWN LAND SALE	
LEASES	(L)
LOCATED LAND	
LICENSE OF OCCUPATION	
MINING RIGHTS ONLY	M.R.O.
SURFACE RIGHTS ONLY	S.R.O.
ROADS	
IMPROVED ROADS	
KING'S HIGHWAYS	
RAILWAYS	
POWER LINES	
MARSH OR MUSKEG	
MINES	
CANCELLED	

NOTES

400' Surface Rights Reservation around all lakes and rivers.

RECEIVED

PLAN NO. M.1159

ONTARIO
MINISTRY OF NATURAL RESOURCES
SURVEY AND MAPPING BRANCH

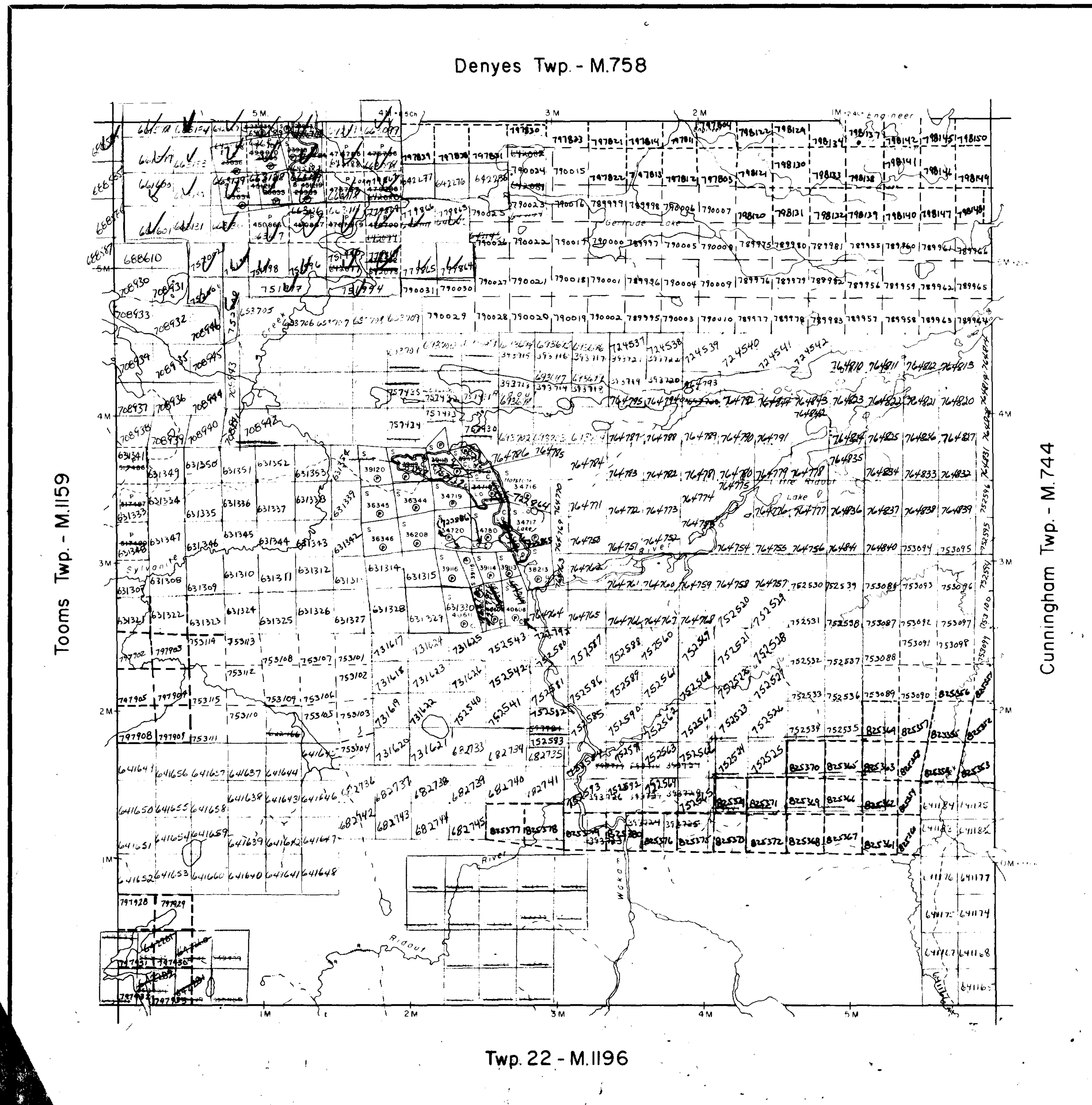
M.1159

TRIM LINE

41015SW0055 2.7178 DENYES

220

TRIM LINE



THE TOWNSHIP OF GREENLAW

DISTRICT OF SUDBURY

PORCUPINE MINING DIVISION

SCALE: 1-INCH = 40 CHAINS

LEGEND

PATENTED LAND	Ⓟ
CROWN LAND SALE	C.S.
LEASES	Ⓛ
LOCATED LAND	Loc.
LICENSE OF OCCUPATION	L.O.
MINING RIGHTS ONLY	M.R.O.
SURFACE RIGHTS ONLY	S.R.O.
ROADS	
IMPROVED ROADS	
KING'S HIGHWAYS	
RAILWAYS	
POWER LINES	
MARSH OR MUSKEG	
MINES	⚒
CANCELLED	C

NOTES

400' Surface Rights Reservation around all lakes and rivers

DATE OF ISSUE
SEP 25 1984
Ministry of Natural Resources
TORONTO

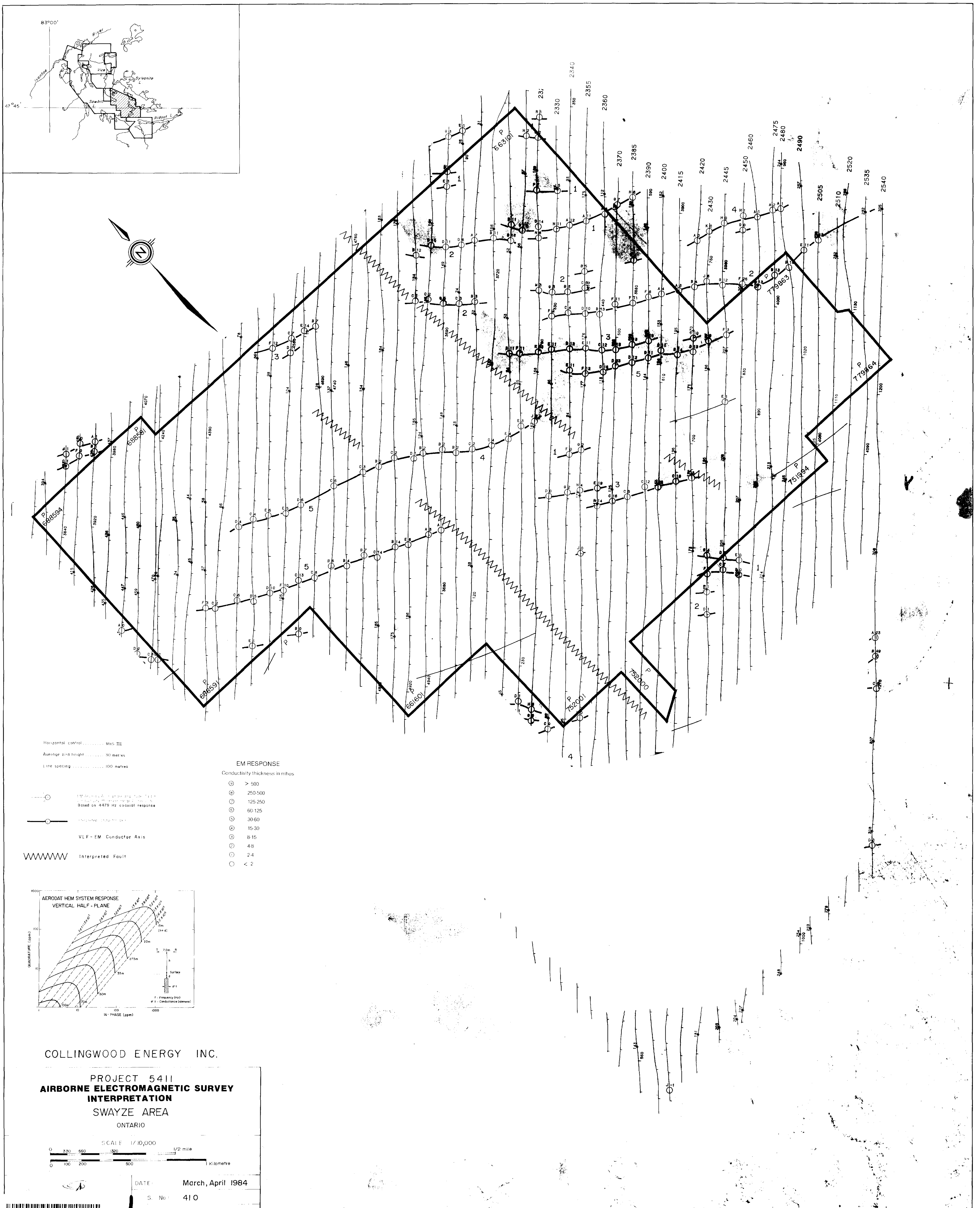
PLAN NO. M.895

ONTARIO
MINISTRY OF NATURAL RESOURCES
SURVEYS AND MAPPING BRANCH

41015SW0055 2.7178 DENYES

230

TRIM LINE



Horizontal control .... MNR
Average bird height .... 30 metres
Line spacing .... 100 metres
EM RESPONSE
Conductivity thickness in mhos
> 500
250-500
125-250
60-125
30-60
15-30
8-15
4-8
2-4
< 2
Based on 4479 Hz coaxial response
VLF - EM Conductor Axis
Interpreted Fault
AERODAT HEM SYSTEM RESPONSE
VERTICAL HALF - PLANE
QUADRATURE (ppm)
IN - PHASE (ppm)
COLLINGWOOD ENERGY INC.
PROJECT 5411
AIRBORNE ELECTROMAGNETIC SURVEY
INTERPRETATION
SWAYZE AREA
ONTARIO
SCALE 1/10,000
1/2 mile
1 Kilometre
DATE: March, April 1984
410
1
240

COLLINGWOOD ENERGY INC.

PROJECT 5411

AIRBORNE ELECTROMAGNETIC SURVEY PROFILES

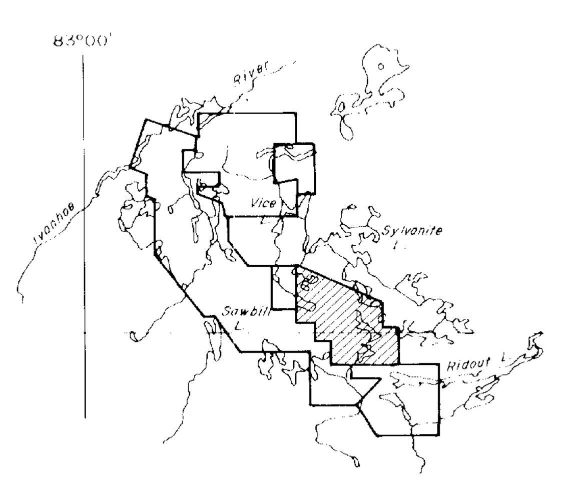
SWAYZE AREA

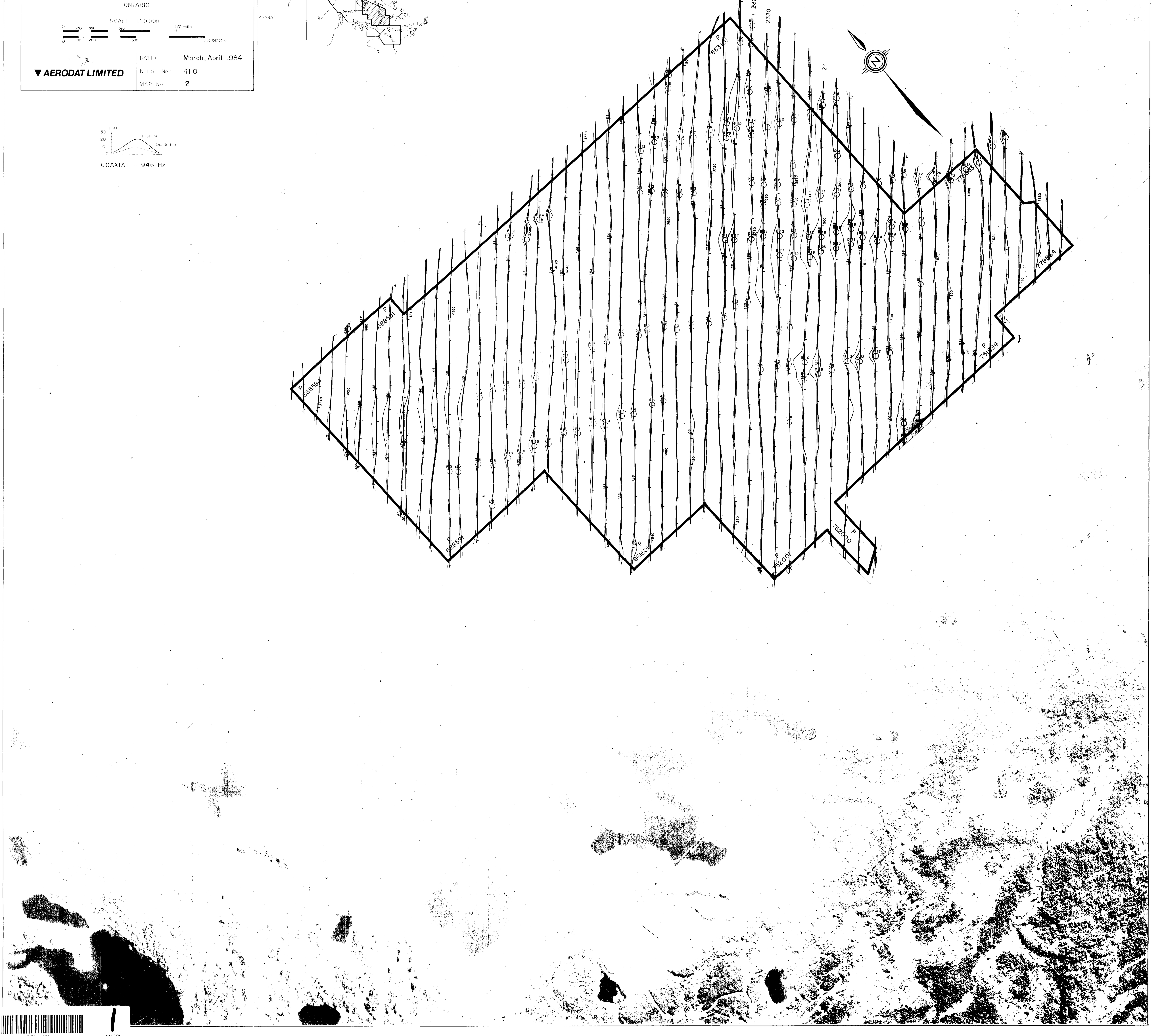
ONTARIO

SCALE 1:20,000

▼ AERODAT LIMITED

DATE:	March, April 1984
N.T.S. No.:	41 O
MAP No.:	2





1

250

COLLINGWOOD ENERGY INC.

PROJECT 5411

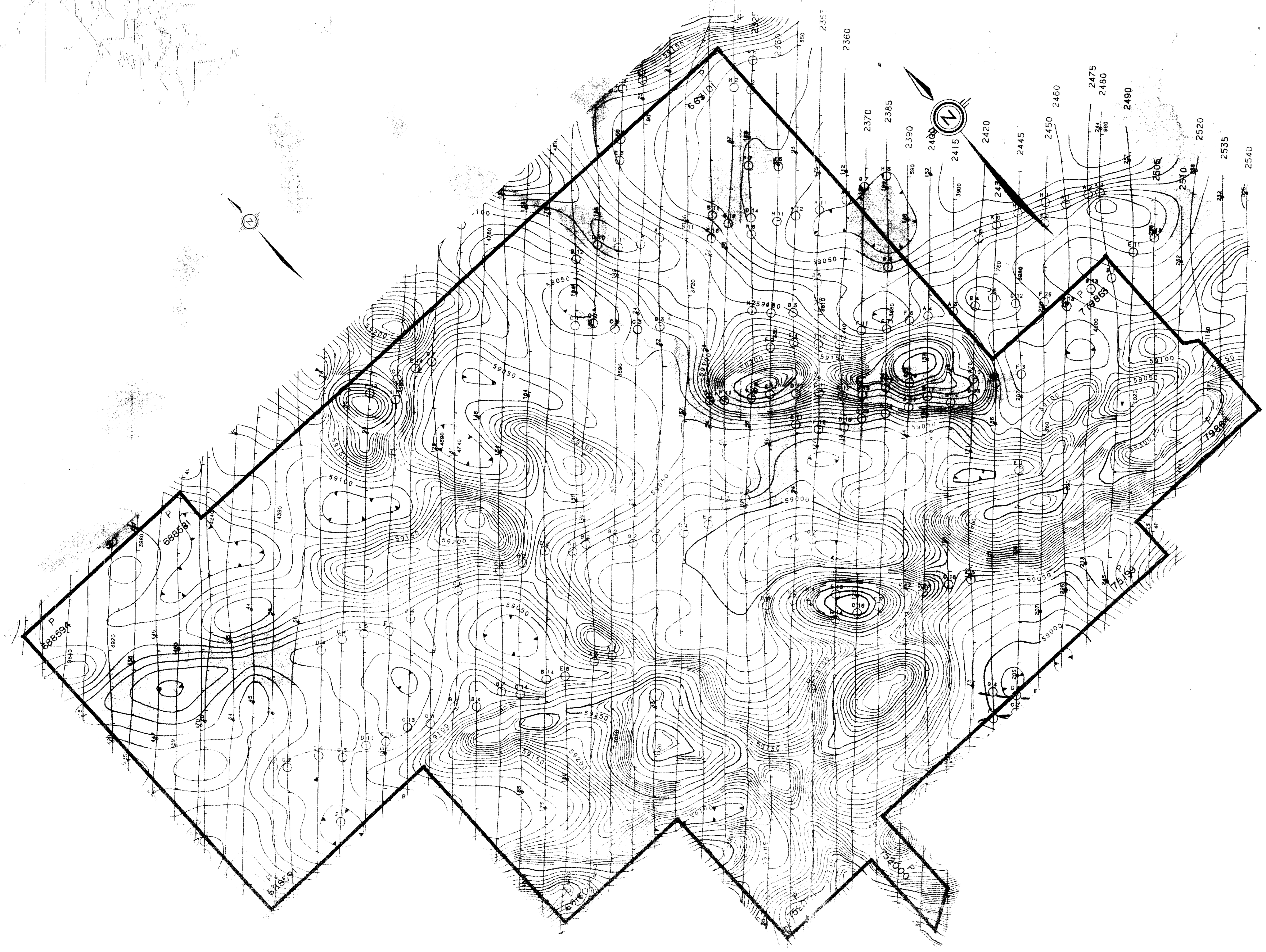
TOTAL FIELD MAGNETIC MAP

SWAYZE AREA

ONTARIO

AERODAT LIMITED

DATE March, April 1984



COLLINGWOOD ENERGY INC.

PROJECT 5411

VLF-EM TOTAL FIELD CONTOURS

SWAYZE AREA

ONTARIO

SCALE 1/10,000

0 330 660 1320 1/2 mile

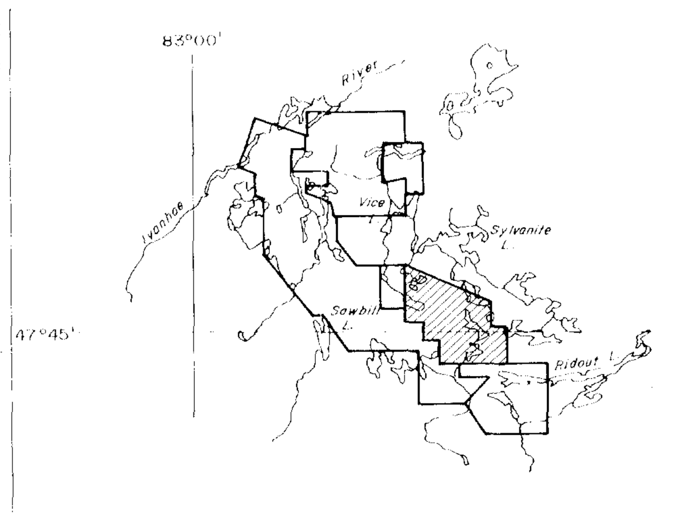
0 100 200 500 1 Kilometre

▼ AERODAT LIMITED

DATE: March, April 1984

N.T.S. No: 41 O

MAP No: 4

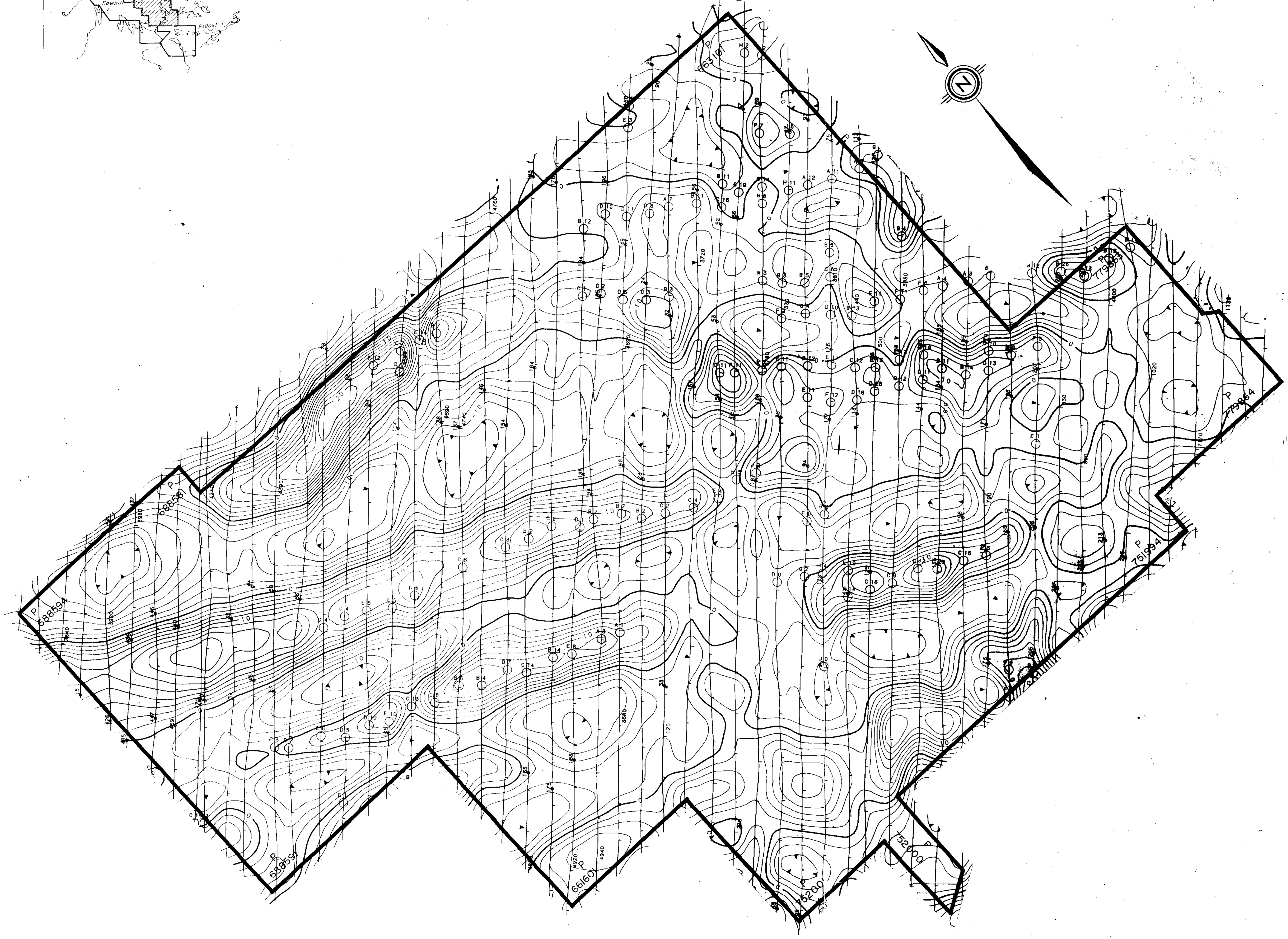


LEGEND

50 %

10 %

2 %



270