REPORT ON COMBINED HELICOPTER-BORNE MAGNETIC AND VLF SURVEY SOUTH PORCUPINE TIMMINS, ONTARIO

Block 4
54 Claims
Eldorado Township

FOR
TIMMINS NICKEL INC.
BY
AERODAT LIMITED
September 25, 1990

J9071

Adriana Carbone
Geologist

Page No.

List of Maps
(Scale 1:10,000)

Basic Maps: (As described under Appendix B of the Contract)

1. **PHOTOMOSAIC BASE MAP;**
   Prepared from available photos from the National Photo Library (Ottawa).

2. **FLIGHT LINE MAP;**
   Showing all flight lines and fiducials with the base map.

3. **TOTAL FIELD MAGNETIC CONTOURS;**
   Showing magnetic values corrected of all diurnal variation with flight lines, fiducials, and base map.

4. **VERTICAL MAGNETIC GRADIENT CONTOURS;**
   Showing magnetic gradient values calculated from the total field magnetics with flight lines, fiducials and base map.

5. **VLF-EM TOTAL FIELD CONTOURS;**
   Showing VLF total field response from the line transmitter with flight lines, fiducials, and base map.

1. INTRODUCTION

This report describes an airborne geophysical survey carried out on behalf of Timmins Nickel Inc. Equipment operated during the survey included a high sensitivity cesium vapour magnetometer, a two frequency VLF-EM system, a video tracking camera, radar altimeter, and an electronic positioning system. Magnetic and altimeter data were recorded both in digital and analog forms. Positioning data was stored in digital form, encoded on VHS format video tape and recorded at regular intervals in local UTM coordinates, as well as being marked on the flight path mosaic by the operator while in flight.

The survey areas are located near South Porcupine, Ontario, and are referred to as Block 1 - Block 7 inclusive. Blocks 1, 2 and 3 were flown on September 3, 1990. Block 4 was flown on September 4, 1990. Block 5 was flown on September 5, 1990. Block 6 was flown on September 8, 1990, and Block 7 was flown on September 7, 1990. Data from twelve flights were used to compile the survey results. The flight lines were oriented at an angle of 90 degrees, with a nominal line spacing of 100 metres (according to Appendix "A" of the contract) for Blocks 2, 5 and Block 6. Blocks 1, 3 and 7 were oriented at an angle of 0 degrees, with a nominal line spacing of 100 metres (according to Appendix "A" of the contract). Block 4 consisted of bi-directional flight lines, a detailed area oriented at an angle of 0 degrees, with a nominal line spacing of 50 metres, while the remaining areas of Block 4 was oriented at 90 degrees with a nominal line spacing of 100 metres (according to Appendix "A" of the contract). Geophysical information is provided in the form of maps at 1:10,000. Coverage and data quality were considered to be well within the specifications described in the service contract.

The purpose of the survey was to record airborne geophysical data over ground that is of interest to Timmins Nickel Inc.

The survey encompasses approximately 1100 line kilometres of the recorded data that were compiled in a map form at a scale of 1:10,000. The maps are presented as part of this report according to specifications laid out by Timmins Nickel Inc.

2. SURVEY AREA LOCATION

The survey areas are depicted on the following index maps.

Block 1 is centred at approximate geographic latitude 48 degrees 22 minutes North, longitude 81 degrees 01 minutes West.

Block 2 is centred at approximate geographic latitude 48 degrees 19 minutes North, longitude 81 degrees 01 minutes West.

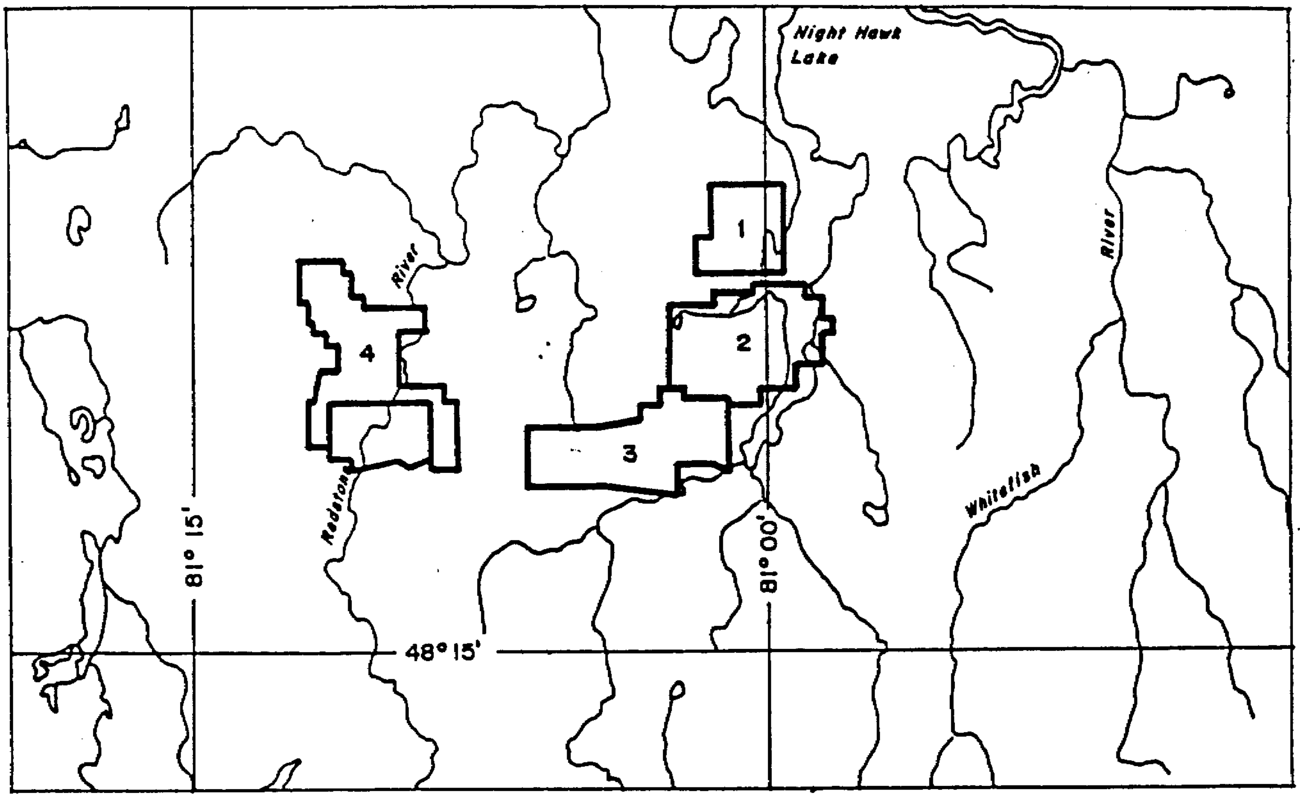
Block 3 is centred at approximate geographic latitude 48 degrees 18 minutes North, longitude 81 degrees 04 minutes West.

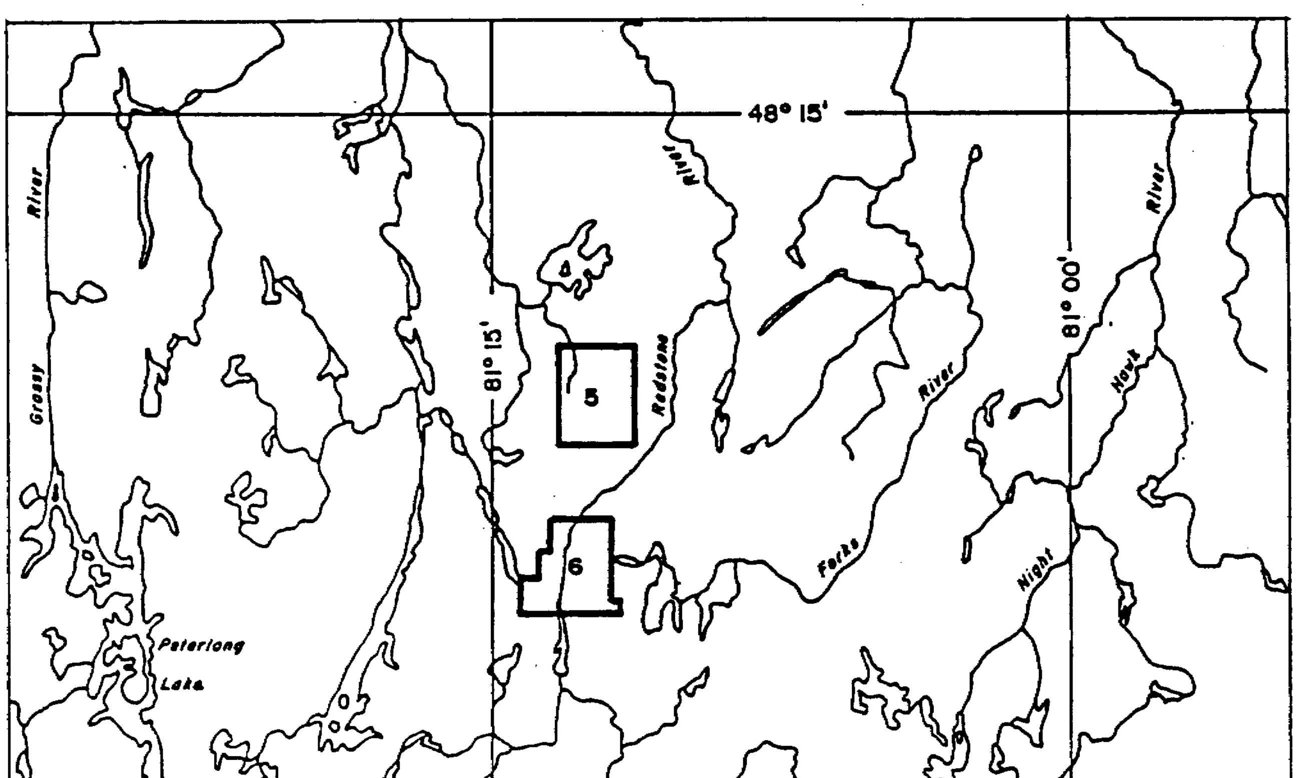
Block 4 is centred at approximate geographic latitude 48 degrees 20 minutes North, longitude 81 degrees 10 minutes West.

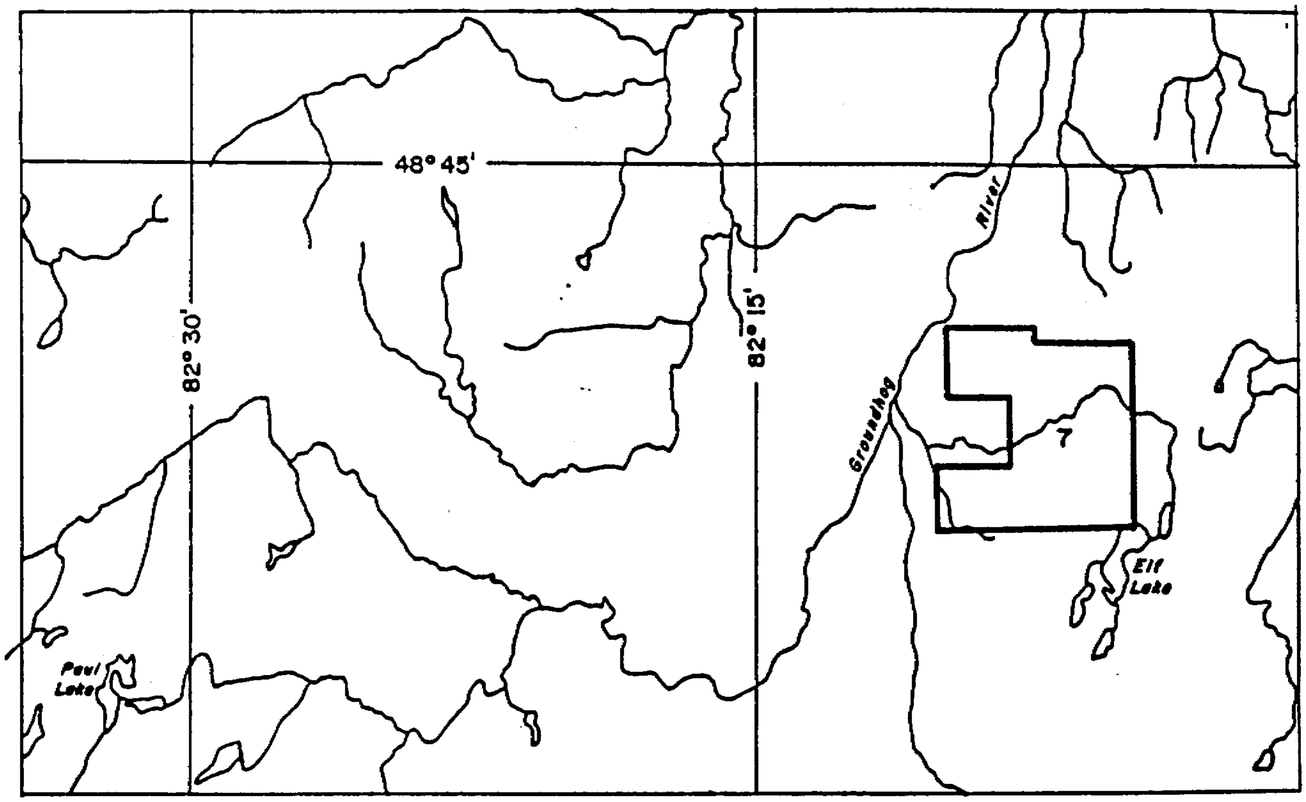
Block 5 is centred at approximate geographic latitude 48 degrees 10 minutes North, longitude 81 degrees 14 minutes West.

Block 6 is centred at approximate geographic latitude 48 degrees 07 minutes North, longitude 81 degrees 14 minutes West.

Block 7 is centred at approximate geographic latitude 48 degrees 41 minutes North, longitude 82 degrees 8 minutes West.


Night Hawk
Lake
1
2
3
4
River
Redstone
River
Whitefish
81° 15'
81° 00'
48° 15'


48° 15'
River
Grassy
River
4
5
6
Redstone
81° 15'
River
Forks
81° 00'
River
Hawk
Night
Peterlong
Lake


48° 45'
82° 30'
82° 15'
Groundhog
River
Paul
Lake
Elf
Lake
7

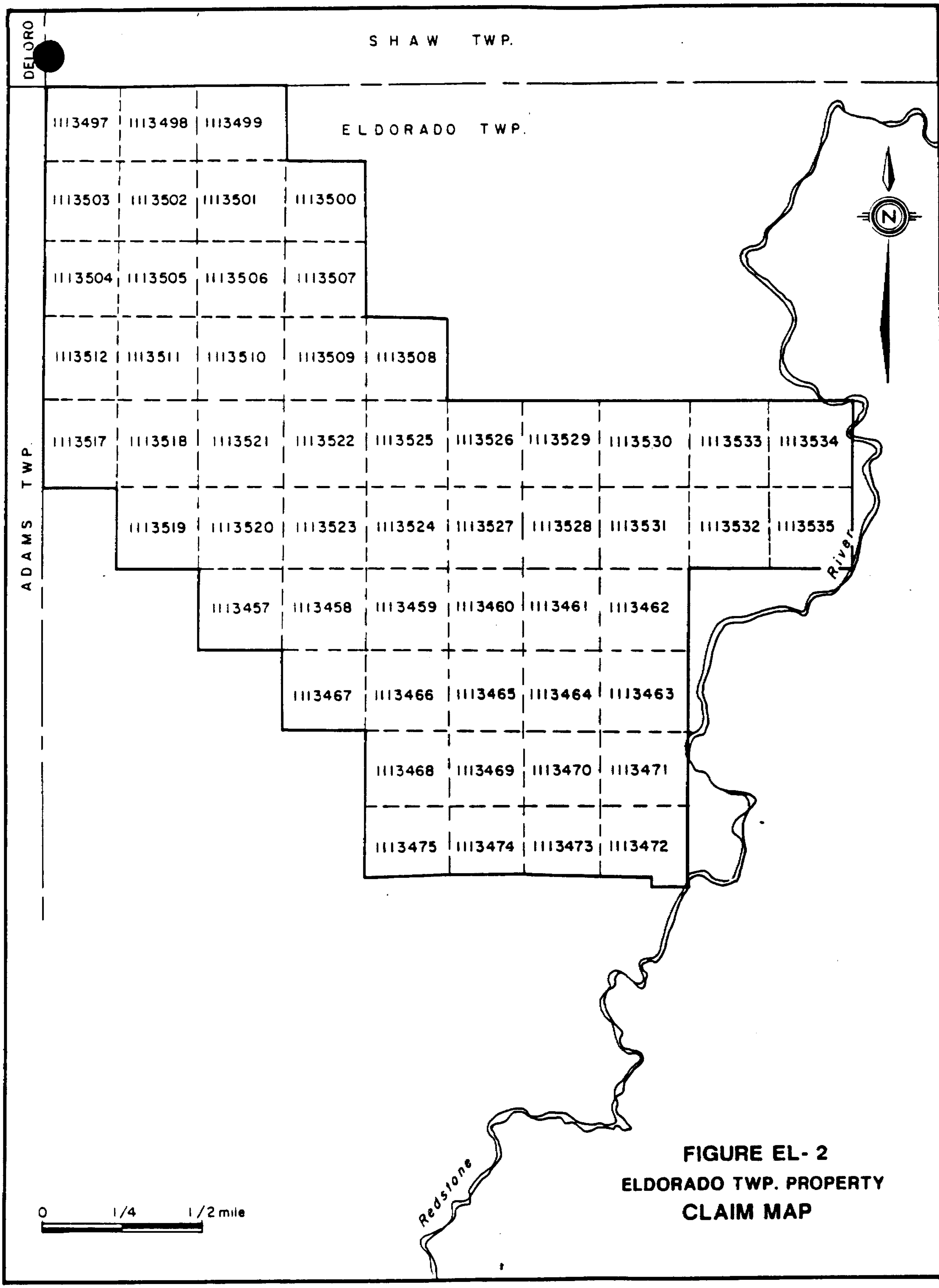


FIGURE EL- 2
ELDORADO TWP. PROPERTY
CLAIM MAP

Block 4
54 Claims
Eldorado Township

P 1113457
P 1113458
P 1113459
P 1113460
P 1113461
P 1113462
P 1113463
P 1113464
P 1113465
P 1113466
P 1113467
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P 1113469
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P 1113531
P 1113532
P 1113533
P 1113534
P 1113535

PROPERTY LOCATION AND ACCESS

The Eldorado Township property (Block 4) is located in the northwestern part of Eldorado Township, approximately 22.4 km southeast of the city of Timmins, Ontario.

The property is comprised of 54 contiguous unpatented mining claims and is wholly-owned by TNI.

Regionally, the Eldorado claim group is situated on the southern limb of the Shaw Township Dome and adjoins the Redstone property to the southeast.

Access to the property can be gained by all-weather gravel road from South Porcupine to the Langmuir deposit in Langmuir Township. From the southeast corner of Shaw Township, the road splits and continues south along the eastern half of Eldorado Township to the Redstone property. Secondary bush roads provide direct access to the south of the Eldorado property.

3. AIRCRAFT AND EQUIPMENT

3.1 Aircraft

An Aerospatiale A-Star 350 B helicopter, (C-GYHT), piloted by Roger Morrow, owned and operated by Peace Helicopters Limited, was used for the survey. Pierre Moisan of Aerodat acted as navigator and equipment operator. Installation of the geophysical and ancillary equipment was carried out by Aerodat. The survey equipment was flown at a mean terrain clearance of 60 metres.

3.2 Equipment

3.2.1 VLF-EM System

The VLF-EM System was a Herz Totem 2 A. This instrument measures the total field and quadrature component of the selected frequency. The sensor was towed in a bird 30 metres below the helicopter.

3.2.2 Magnetometer System

The magnetometer employed a Scintrex Model VIW 2321 H8 cesium, optically pumped magnetometer sensor. The sensitivity of this instrument was 0.1 nanoTeslas. The sensor was towed in a bird 30 metres below the helicopter.

3.2.3 Magnetic Base Station

An IFG proton precession 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 to facilitate later correlation.

3.2.4 Altimeter System

A King KRA 10 radar altimeter was used to record terrain clearance. The output from the instrument is a linear function of altitude for maximum accuracy.

3.2.5 Tracking Camera

A Panasonic video flight path recording system was used to record the flight path on standard VHS format video tapes. The system was operated in continuous mode and the flight number, real time and manual fiducials were registered on the picture frame for cross-reference to the analog and digital data.

3.2.6 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
VLT	VLF-EM Total Field, Line	25 %/cm
VLQ	VLF-EM Quadrature, Line	25 %/cm
VOT	VLF-EM Total Field, Ortho	25 %/cm
VOQ	VLF-EM Quadrature, Ortho	25 %/cm
RALT	Radar Altimeter	100 ft./cm
MAGF	Magnetometer, fine	25 nT/cm
MAGC	Magnetometer, coarse	250 nT/cm

3.2.7 Digital Recorder

A DGR 33:16 data system recorded the survey on magnetic tape. Information recorded was as follows:

Equipment	Recording Interval
VLF-EM	0.20 seconds
Magnetometer	0.20 seconds
Altimeter	0.20 seconds
Nav System	0.20 seconds

3.2.8 Radar Positioning System

A Mini-Ranger MRS-III radar navigation system was used for both navigation and flight path recovery. Transponders sited at fixed locations were interrogated several times per second and the ranges from these points to the helicopter were measured to a high degree of accuracy. A navigational computer triangulated the position of the helicopter and provided 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

A photomosaic base map at a scale of 1:10,000 was prepared from available photos from the National Photo Library (Ottawa).

4.2 Flight Path Map

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 was calculated by triangulation. It is estimated that the flight path is generally accurate to about 10 metres with respect to the topographic detail on the base map.

The flight lines have the time and the navigator's manual fiducials for cross reference to both analog and digital data.

4.3 Magnetics

4.3.1 Total Field Magnetic Contours Map

The magnetic data from the high sensitivity cesium magnetometer provided virtually a continuous magnetic reading when recording at 0.2 second intervals. The system is also noise free for all practical purposes.

A sensitivity of 0.1 nanoTesla (nT) allows for the mapping of very small inflections in the magnetic field, resulting in a contour map that is equal to or exceeds ground data in quality and accuracy.

The aeromagnetic data was corrected for diurnal variations by adjustment with the digitally recorded base station magnetic values. No correction for regional variation was applied. The corrected data was interpolated onto a regular grid at a 25 metre true scale interval using an Akima spline technique. This grid provided the basis for threading the presented contours at a 2 nT interval.

The contoured aeromagnetic data has been presented on a Cronaflex copy of the base map with flight lines.

4.3.2 Vertical Gradient Contour Map

The vertical magnetic gradient was calculated from the total field magnetic data. Contoured at a 0.2 Nt/m interval, the data was presented on a cronaflex copy of the base map with flight lines.

4.4 VLF-EM Total Field Contours

The VLF data was interpolated onto a regular grid at a 25 metre true scale interval using an Akima spline technique. This grid provided the basis for threading the contours at a 2% interval.

The VLF-EM signal from the line transmitting station was compiled as contours in map form on cronaflex copies of the base map with flight lines.

The VLF stations used for Blocks 1, 2, 3 6 and 7 were NAA, Cutler Maine, broadcasting at 24.0 Khz, and NSS, Annapolis, Md., broadcasting at 21.4 kHz. NAA was used as the line transmitting station for Blocks 1, 3, 6 and 7. NSS was used as the orthogonal station for Blocks 1, 3, 6 and 7. NSS was used as the line transmitting station for Block 2 and NAA was used as the orthogonal station.

The VLF stations used for Blocks 4 and 5 were NLK, Seattle, Washington, broadcasting at 24.8 kHz, and NAA, Cutler, Maine, broadcasting at 24.0 kHz. NLK was used as the line transmitting station for Blocks 4 and 5 and NAA was used as the orthogonal station.

Respectfully submitted,

September 24, 1990

Adriana Carbone
Geologist

R. Sprenle
for
A Carbone

APPENDIX I

PERSONNEL

FIELD

Flown	September, 1990
Pilot	Roger Morrow
Operator	Pierre Moisan

OFFICE

Processing	A. Carbone G. McDonald
Report	A. Carbone

APPENDIX II

GENERAL INTERPRETIVE CONSIDERATIONS

Magnetics

A digital base station magnetometer was used to detect fluctuations in the magnetic field during flight times. The airborne magnetic data was levelled by removing these diurnal changes. The Total Field Magnetic map shows the levelled magnetic contours, uncorrected for regional variation.

The Calculated Vertical Gradient map shows contours of the magnetic gradient as calculated from the total field magnetic data. The zero contour shows changes in the magnetic lithologies and will coincide closely with geologic contacts assuming a steeply dipping interface. Thus this data may be used as a pseudo-geologic map.

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 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 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 thisaltered 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.

APPENDIX II

CERTIFICATE OF QUALIFICATIONS

I, Adriana Carbone, certify that:

1. I hold a B.Sc., in Geological Sciences from the University of Windsor, Ontario.
2. I reside at 2041 Banbury Crescent, in the Town of Oakville, Ontario.
3. I have been engaged in a professional role in the minerals industry in Canada for the past three years. I have been employed by Aerodat Limited since May 1990, and I currently hold a position as a Geologist.
4. I have been a member of the Prospectors' and Developers' Association since 1987.
5. The accompanying report was prepared from a review of the proprietary airborne geophysical survey flown by Aerodat Limited for Timmins Nickel. I have not personally visited the property.
6. I have no interest, direct or indirect, in the property described nor do I hold securities in Timmins Nickel.

Signed,

Adriana Carbone

Adriana Carbone
Geologist

Mississauga, Ontario
February 14, 1991

Ministry of Northern Development and Mines
Ontario

Mining Act

DOCUMENT No. W 9006 · 60526

2.13775

Nov 25 DEC. 24

Report of Work
(Geophysical, Geological and Geochemical Surveys)

Instructions
- Please type or print.
- Refer to Section 77, the Mining Act for assessment work requirements and maximum credits allowed per survey type.
- If number of mining claims traversed exceeds space on this form, attach a list.
- Technical Reports and maps in duplicate should be submitted to Mining Lands Section, Mineral Development and Lands Branch.

Type of Survey(s): AIRBORNE MAGNETIC & V.L.F. SURVEY
Mining Division: PORCUPINE
Township or Area: ELDORADO TWP.
Recorded Holder(s): TIMMINS NICKEL INC.
Prospector's Licence No.: T5306
Address: SUITE 205, 155 UNIVERSITY AVE, TORONTO, ONT
Telephone No.: (416) 367-9545
Survey Company: AERODAT LIMITED
Date of Survey (from & to): 4 9 90 (Day Mo. Yr.) – 4 9 90 (Day Mo. Yr.)
Name and Address of Author (of Geo-Technical Report): ADRIANA CARBONE c/o 3883 NASHUA DRIVE MISSISSAUGA, ONT

Credits Requested per Each Claim in Columns at right

Special Provisions		Days per Claim
For first survey: Enter 40 days. (This includes line cutting)	Geophysical	
	- Electromagnetic	
	- Magnetometer	
For each additional survey: using the same grid: Enter 20 days (for each)	- Other	
	Geological	
	Geochemical	
Man Days	Geophysical	Days per Claim
Complete reverse side and enter total(s) here	- Electromagnetic	
	- Magnetometer	
	- Other	
	Geological	
	Geochemical	
Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic	40
	Magnetometer	40
	Other	

RECEIVED
NOV 30 1990
MINING LANDS SECTION

Total miles flown over claim(s).

Date: Oct 24/90
Recorded Holder or Agent (Signature): R.M. Sprule

Mining Claims Traversed (List in numerical sequence)

Prefix	Number	Prefix	Number	Prefix	Number
P	1113457	P	1113474	P	1113510
	1113458		1113475		1113511
	1113459		1113497		1113512
	1113460		1113498		1113517
	1113461		1113499		1113518
	1113462		1113500		1113519
	1113463		1113501		1113520
	1113464		1113502		1113521
	1113465		1113503		1113522
	1113466		1113504		1113523
	1113467		1113505		1113524
	1113468		1113506		1113525
	1113469		1113507		1113526
	1113470		1113508		1113527
	1113471		1113509		1113528
	1113472				
	1113473				

OVER

Total number of mining claims covered by this report of work: 54

Certification Verifying Report of Work

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

Name and Address of Person Certifying: RICHARD SPRULE c/o M.V. WHITE & ASSOCIATES Ltd., P.O. Box 1430 TIMMINS, ONT
Telephone No.: 264-4709
Date: Oct 24/90
Certified By (Signature): R.M. Sprule

For Office Use Only

Total Days Cr. Recorded	Date Recorded	Mining Recorder
4320	OCT. 25/90	"ASTG" Robert Bailey
	Date Approved as Recorded	Provincial Manager, Mining Lands
	Feb. 15/91	Ron C Gashinski

Received Stamp: PORCUPINE MINING DIVISION RECEIVED OCT 25 1990 / RECORDED OCT 25 1990

1362 (89/06)

8 ~~1113528~~

1113 529

1113 530

1113 531

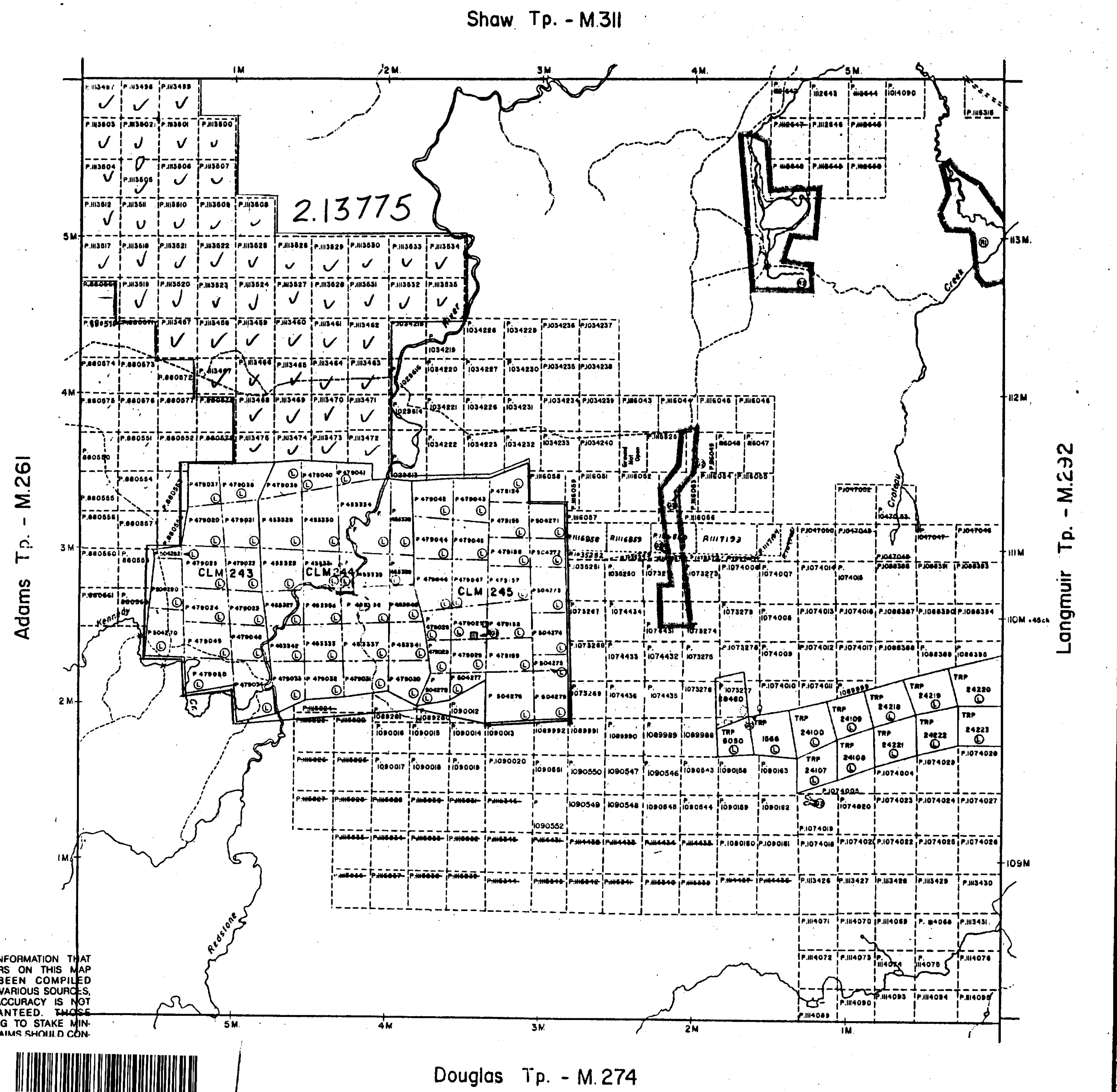
1113532

1113533

1113534

1113535

2.13775



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 ...

42A06SE0080 2.13775 ELDORADO

THE TOWNSHIP OF

ELDORADO

DISTRICT OF TIMISKAMING

PORCUPINE MINING DIVISION

SCALE: 1-INCH = 40 CHAINS

LEGEND

PATENTED LAND	or Ⓟ
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.
PATENTED S.R.O.	

NOTES

400' Surface Rights Reservation along the shores of all lakes and rivers.

This township lies within the Municipality of CITY of TIMMINS

SAND and GRAVEL

GRAVEL, FILE 192267

GRAVEL, FILE 171886

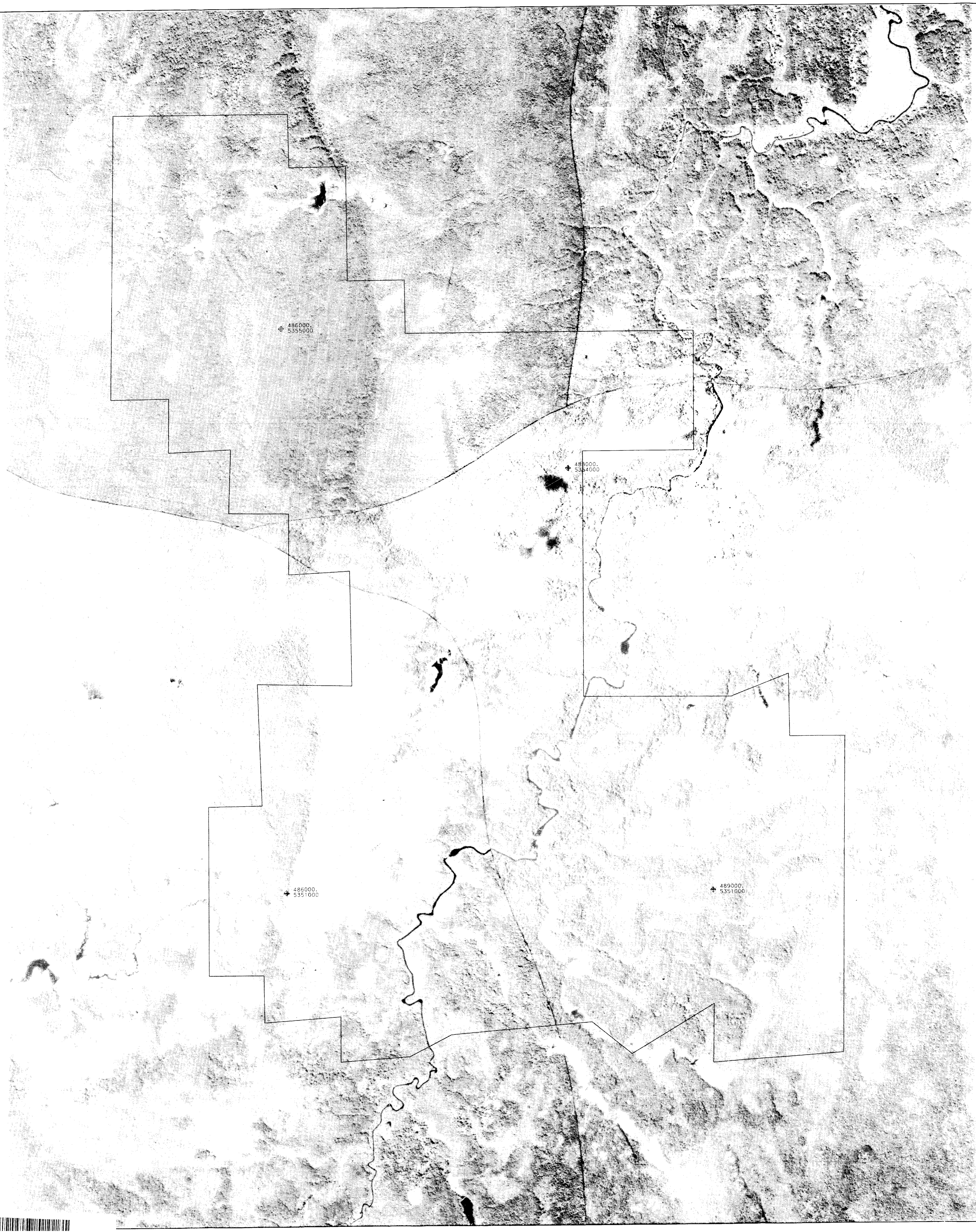
DEC 19 1990

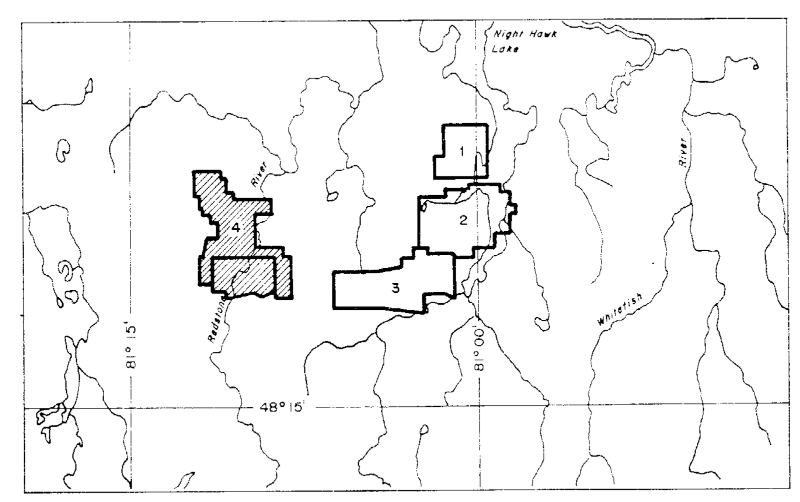
Ⓡ DUCKS UNLIMITED — PENDING APPLICATION UNDER THE PUBLIC LANDS ACT S.R.O. WITHDRAWN

DUCKS UNLIMITED — PENDING APPLICATION UNDER THE PUBLIC LANDS ACT S.R.O. WITHDRAWN

PLAN NO. M.276

MINISTRY OF NATURAL RESOURCES ONTARIO





TIMMINS NICKEL

BASE MAP

BLOCK 4

TIMMINS NICKEL

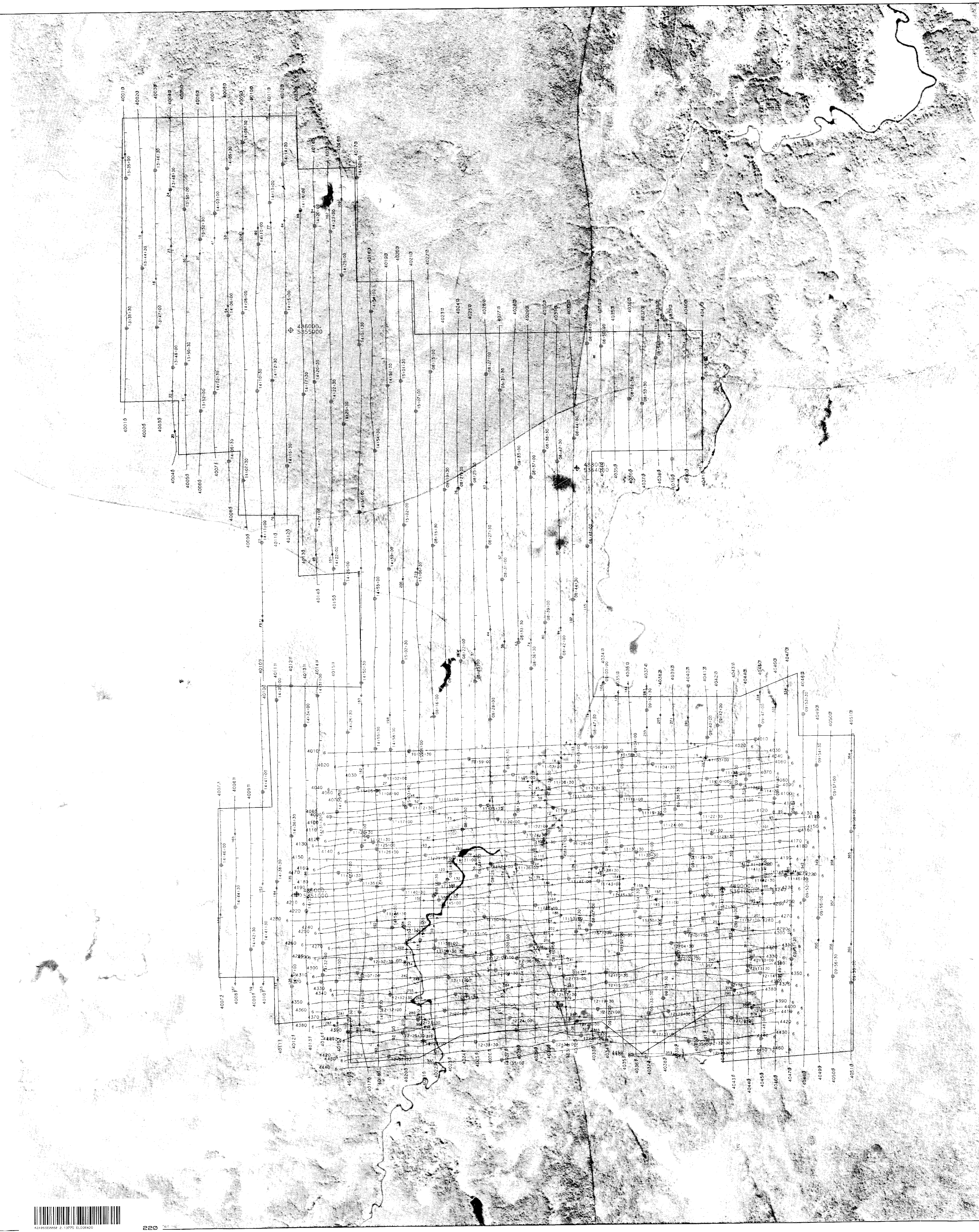
SCALE 1:10,000

0 330 660 1320 2640 Feet

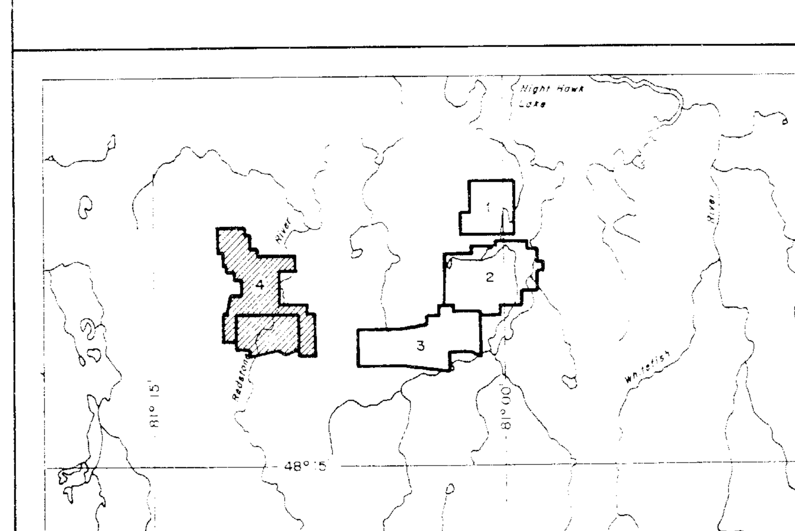
0 100 200 500 1000 Metres

AERODAT LIMITED

DATE:	SEPTEMBER 1990
NTS No:	42 A/6
MAP No:	1 J9071 - 1



Flight Path



TIMMINS NICKEL

FLIGHT PATH

BLOCK 4*

TIMMINS NICKEL

AERODAT LIMITED

DATE: SEPTEMBER 1990

NTS No: 42 A/6

MAP No: 2

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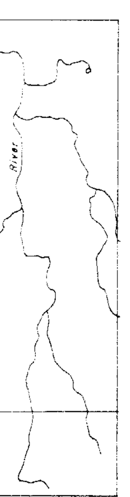
Flight Path

Magnetics



TIMMINS NICKEL

TOTAL FIELD MAGNETIC CONTOURS

BLOCK 4

TIMMINS NICKEL

AERODAT LIMITED

DATE: SEPTEMBER 1990

NTS NO: 42 A/6

MAP NO: 3

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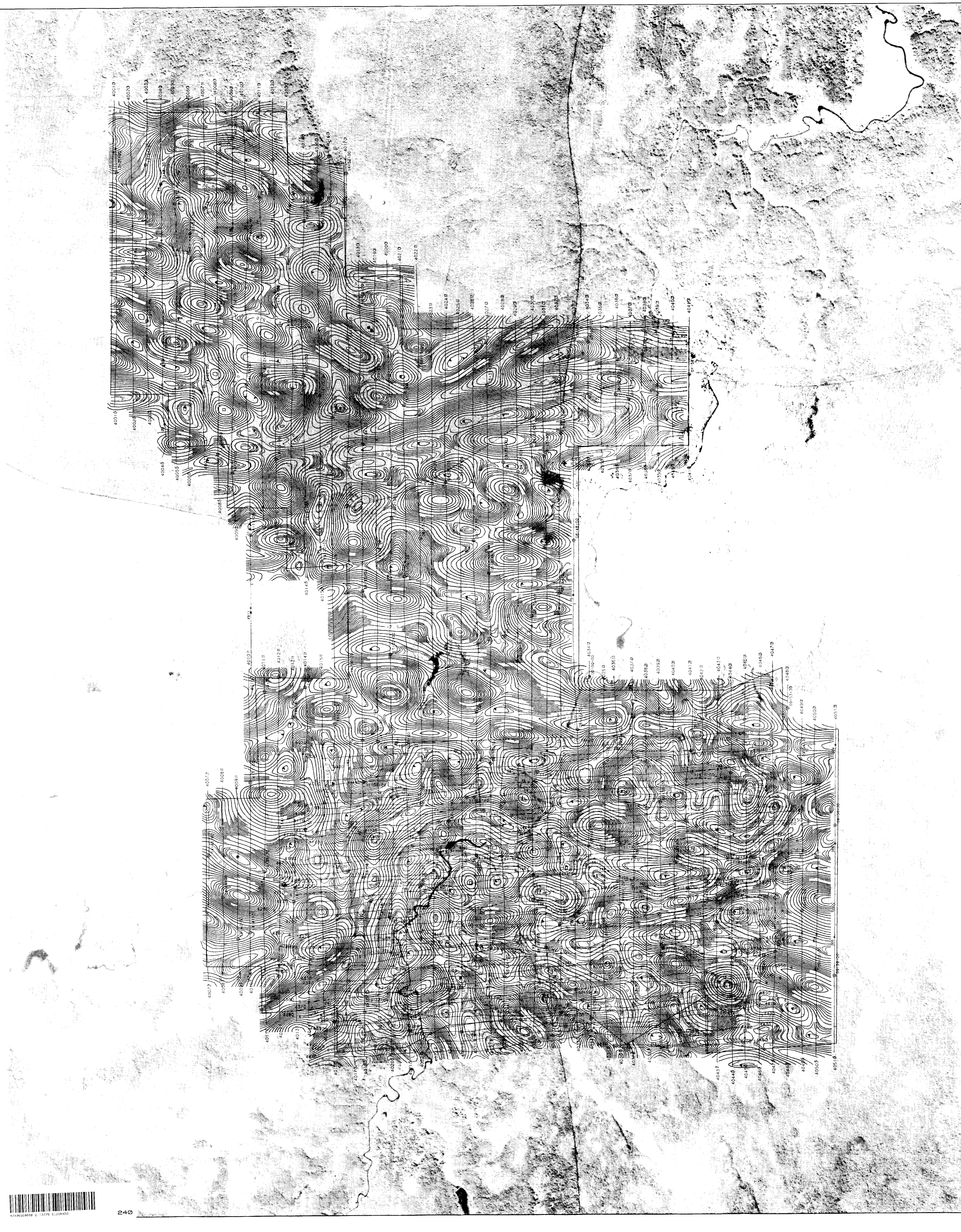
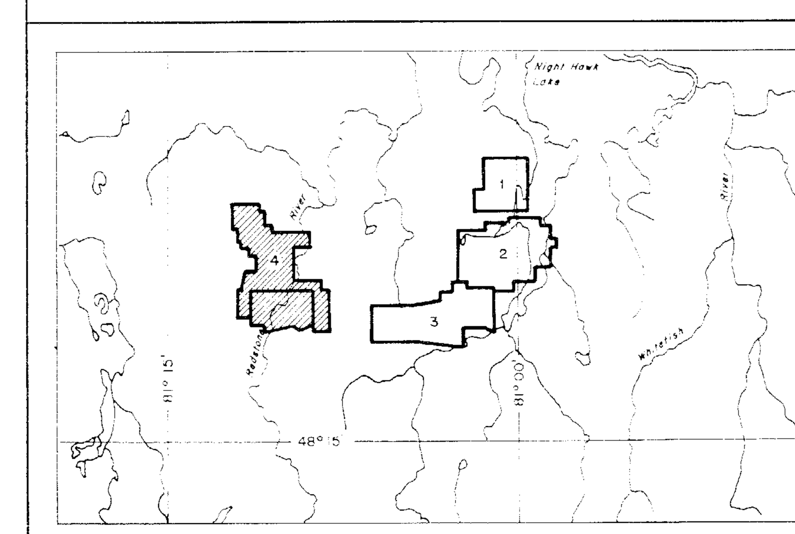


Flight Path

Vertical Gradient



TIMMINS NICKEL

CALCULATED VERTICAL MAGNETIC GRADIENT

BLOCK 4

TIMMINS NICKEL

AERODAT LIMITED

DATE: SEPTEMBER 1990

NTS NO: 42 A/6

MAP NO: 4

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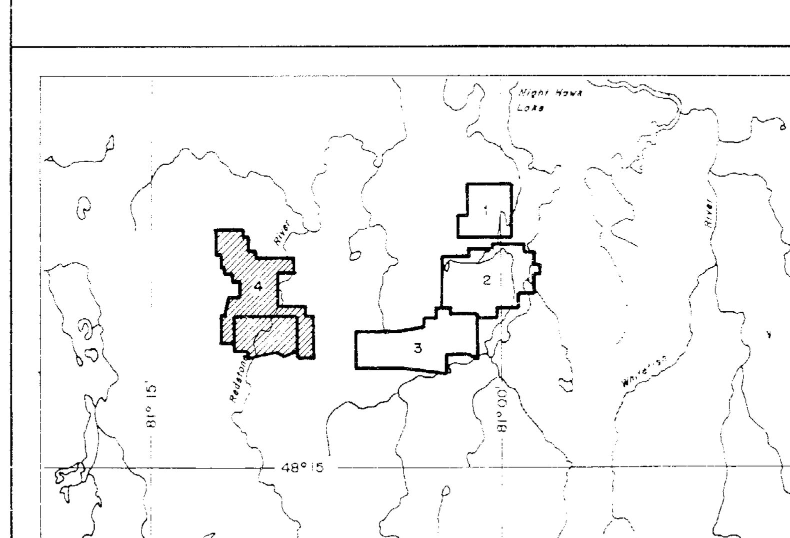
Flight Path

VLF-EM



TIMMINS NICKEL

VLF-EM TOTAL FIELD CONTOURS (LINE CHANNEL)

BLOCK 4

TIMMINS NICKEL

AERODAT LIMITED

DATE: SEPTEMBER 1990

NTS NO: 42 A/6

MAP NO: 5

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250