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REPORT ON COMBINED HELICOPTER BORNE MAGNETIC, ELECTROMAGNETIC, VLF AND RADIOMETRIC SURVEY McVITTIE TOWNSHIP, ONTARIO

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MINING LANDS SECTION

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LAC MINERALS LIMITED

by

AERODAT LIMITED

SEPTEMBER, 1984

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LIST OF MAPS

(Scale: 1:4800)

Also provided is a two-colour master overlay of the 4510 Hz coaxial profiles/4137 Hz coplanar profiles.

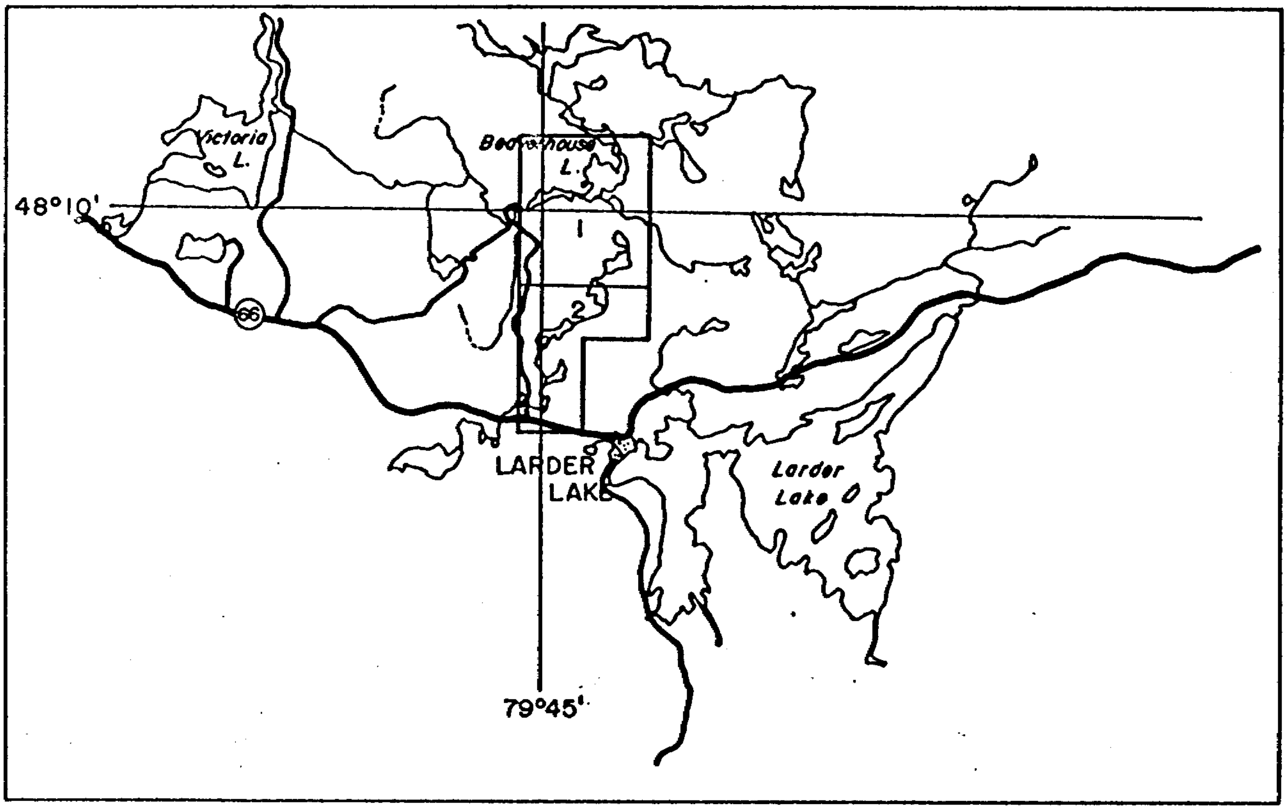
1. INTRODUCTION

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

The survey was flown on June 30, 1984, covering an area located northwest of Larder Lake in McVittie Township, Ontario. A total of 368.3 line kilometers of data were collected at a line spacing of 100 meters.

2. SURVEY AREA LOCATION

The index map below outlines the survey area. The flight line direction was N/S at a spacing of 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 932 and 4510 Hz and a horizontal coplanar coil pair at 4137 Hz. The transmitter-receiver separation was 7 meters. Inphase 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 12 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 12 meters below the helicopter.

3.2.4 Radiometric System

The system used was a McPhar/Torelco 4-channel differential spectrometer with 1000 cubic inches of crystal detector volume. The instrument was stabilized with a Cesium source.

The output of the system in counts per minute (cpm) was via ratemeters with an analog time constant of 2 seconds for Total Count and Potassium channels, and 4 seconds for Thorium and Uranium channels.

The window settings were as follows:

TC	0.8	to	3.0	MeV
K	1.37	to	1.57	MeV
U	1.66	to	1.86	MeV
Th	2.41	to	2.01	MeV

3.2.5 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.

3.2.6 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.

3.2.7 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.

3.2.8 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	Low freq. inphase	2 ppm/mm
01	Low freq. quadrature	2 ppm/mm
02	High freq. inphase	2 ppm/mm
03	High freq. quadrature	2 ppm/mm
04	Mid freq. inphase	4 ppm/mm
05	Mid freq. quadrature	4 ppm/mm
06	VLF-EM Total Field	2.5%/mm

Channel	Input	Scale
07	VLF-EM Quadrature	2.5%/mm
08	Thorium	400 cpm/mm
09	Uranium	400 cpm/mm
10	Potassium	1600 cpm/mm
11	Total Count	6400 cpm/mm
13	Altimeter (500 ft at top of chart)	10 ft/mm
14	Magnetometer	2.5 gamma/mm
15	Magnetometer	25 gamma/mm

3.2.9 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	0.1 second
Magnetometer	0.5 second
Altimeter	0.7 second
Fiducial (time)	1.0 second
Fiducial (manual)	0.2 second
MRS III	0.2 second
Spectrometer	0.7 second

3.2.10 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 maps are photomosaics at a scale of 1:4800.

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 inphase 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 inphase and quadrature responses of the 932 Hz coaxial configuration coils were presented with flight path and electromagnetic anomaly information on the base map.
Also provided but not included as part of this report is a two-colour master overlay of the 4510 Hz coaxial/4137 Hz coplanar profiles.

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 has been presented with flight path and 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 has been presented with flight path and electromagnetic anomaly information on the base map.

4.5 Radiometric Profile Maps

The spectrometer data was converted to the units cps and then filtered to reduce statistical variations. Background levels were identified from lines flown above 1000 ft. as well as portions of lines flown over lakes, and a linear levelling procedure was performed. Profiles of Thorium, Potassium, and Uranium have been presented with flight path and electromagnetic anomaly information on the base map.

5. INTERPRETATION

Anomalous zones have been identified by the survey in the Larder Lake area. Electromagnetically, the region is not very active, resulting in only a small number of bedrock conductors being interpreted. Many of the wider responses are due to probable conductive overburden sources. The complexity of the geology in the area is evident both on the ODM Geological Map #2205 and in the total field magnetic contours. Geological units and structural features can be interpreted from the latter map providing useful structural information for exploration work. The radiometric data indicate a fairly inactive survey area - this may be due to a number of factors including rock composition, outcrop frequency, and overburden thickness. Local correlation with known or interpreted geological features may provide model radiometric signatures to help identify similar occurrences elsewhere.

EM Conductors

The electromagnetic profile maps were analysed to identify those responses typical of bedrock conductors. As discussed in Appendix I, the profile shape can indicate the general geometry of the conductive source. Anomalies with characteristics of a thin steeply dipping conductive sheet were interpreted to be of bedrock origin.

The process of conductor identification was based primarily on profile shape with little consideration given to the estimated conductance. However, this parameter was calculated by application of the coaxial inphase and quadrature responses to the phasor diagram for the vertical half-plane model. This was carried out be computer and the results are tabulated in Appendix II and presented on the interpretation map in symbolized form.

The estimated conductance is a measure of the conductive properites of the source. A low conductance of say 4 mhos or less is indicative of electrolytic conduction in faults or shears or possibly minor disseminated mineralization. Higher conductances indicate that electronic conduction is a factor and that significant sulphide or graphite mineralization is present.

Gold, as a result of its low concentration, and certain base metal sulphides due to poor electrical conduction, cannot be expected to produce a high conductance anomaly. Accessory conductive mineralization may produce a recognizable response and indirectly provide an electromagnetic signature. Similarly, a fault or shear zone, favorable to mineral emplacement, may be identified by electrolytic, as opposed to mineral, conductivity.

A few conductor axes have been interpreted from the electromagnetic profile data. Those identified as being of bedrock origin have been numbered and are described below.

1 The response profile shape of this one line anomaly is indicative of a dip to the north.

2 This conductor flanks a magnetic contact, increasing the probability of a bedrock origin.

3 This axis is positioned along the edge of a conductive overburden patch,but the response shape is quite suggestive of a bedrock origin.

A number of narrow conductive zones have been labelled as "possible" bedrock conductors, where the electromagnetic response was insufficiently diagnostic for a positive bedrock interpretation. Many of these zones occur along the edges of broader, likely surficial patches, suggesting responses due to edge effects.

Trends in the VLF-EM data agree with those in the HEM data, the VLF-EM highs coinciding with conductive zones evident from the EM profile maps. Axes have not been drawn as those of most interest (i.e. narrow zones) coincide with chosen HEM conductors.

6. RECOMMENDATIONS

A number of conductors have been identified by the survey based on the geophysical results alone. The interpreted bedrock conductor axes deserve ground follow-up consideration as zones potentially favourable to gold mineralization. The possible bedrock conductors warrant investigation only where favourable geological conditions exist.

The relative prioritization of the electromagnetic conductors for further investigation is best left to those most familiar with the detailed geology of the area.

Respectfully submitted,
AERODAT LIMITED

Glenn A. Boustead

September 10, 1984

Glenn A. Boustead, B.A.Sc.

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.

Gamma Spectrometry

Gamma radiation, entering a detector made of thallium actuated sodium iodide will cause a scintillation or light flash. The energy of the event is proportional to the energy of the gamma particle and can be measured by the spectrometer. Different naturally occurring isotopes emit gamma radiation of different energies, a factor that facilitates recognition of the emitting source. Parent elements that lead to gamma radiation and are of geologic interest are potassium, uranium and thorium. In the case of uranium and thorium it is a daughter product in their decay series that is monitored by the system. The relationship is as follows:

Parent	Daughter	Monitored Gamma Energy Level
Thorium 232	Thalium 208	2.615 MeV.
Uranium 238	Bismuth 214	1.76 MeV.
Potassium 40		1.46 MeV.

The count level measured for each of these energy levels is proportional to the concentration of Tl208, Bi214 or K40. If the daughter products have not been separated from the parent the concentrations are in "equilibrium" and the parent can be expected to be present in proportion to the concentration of the daughter. The parent most often in "disequilibrium" is U238 since a gaseous daughter product, radon, exists between U238 and Bi214 and is therefore quite mobile. Solubility of intermediate daughter products is also a significant factor.

In addition to the geological sources of gamma radiation there are cosmic and atmospheric sources. A background count rate that increases with altitude is produced by the cosmic source. Atmospheric background from dust and gas will vary with time, local and meteorological conditions. Estimates of the combined atmospheric and cosmic levels are made over larger bodies of water or at altitude where the geological component can be considered insignificant. A correction is applied by linear interpolation and subtraction of these levels as a function of time.

The Compton effect leads to secondary, lower energy event or events being produced from the original gamma emmission. Statistically, for a given count rate measured in an energy window a smaller proportion will predictably be noted in a lower channel.

U Compton corrected = $U - \alpha Th$

K Compton corrected = $K - \beta Th - \gamma U$

α, β and γ are the Compton correction coefficients.

Gamma radiation is absorbed by intervening material such as overburden, water and air. Several feet of water or soil can totally mask an underlying radiation source. Furthermore, simple distance from source to detector without consideration of intervening material will lessen the intensity of radiation.

Over a large area source, a diameter several times the detector height, the variation of count rate as a function of altitude behaves exponentially and an approximate correction for variation in flying height can be made. A system may also be calibrated to predict the apparent concentration of the source element on the ground. This approach is also based on the assumption of a large area source.

If the source is a limited area of outcrop, the corrections for altitude and estimates of concentration described above are invalid. A correction to a lower elevation and a concentration estimation will be underestimated. The smaller the exposure the more serious the underestimation.

The major factor leading to variations in count rate is expected to be due to supression caused by water and overburden. In areas deemed to have similiar outcrop conditions, a change of count rate will be indicative of a compositional change in the rock. In general, the activity in sedimentary rocks and metamorphosed sediments is higher than that in igneous and other metamorphic types, with the exception of potassium-rich granites. For igneous rocks, those of acid to intermediate composition can generally be expected to have higher levels of activity than the more basic rocks.

APPENDIX II

Anomaly List

ANOMALY LIST, LARDER LAKE NORTH

FLIGHT	LINE	ANOMALY	CATEGORY	FREQUENCY 4575 INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
1	10	A	0	2.1	9.5	0.0	0	47
1	10	B	0	2.7	13.7	0.0	0	55
1	20	A	0	3.4	13.1	0.0	0	39
1	20	B	0	2.3	10.3	0.0	0	40
1	140	A	0	6.0	18.3	0.1	0	35
1	150	C	0	9.7	22.3	0.3	6	27
1	160	A	0	12.6	30.6	0.3	0	29
1	170	B	0	2.3	20.3	0.0	1	22
1	170	C	0	9.8	25.3	0.2	0	34
1	180	A	0	6.7	20.2	0.1	0	32
1	180	B	0	2.7	17.7	0.0	0	31
1	190	D	0	3.2	19.0	0.0	1	25
1	190	E	0	3.5	21.7	0.0	5	20
1	190	F	0	4.6	18.6	0.0	0	34
1	201	A	0	3.7	13.7	0.0	0	34
1	201	B	0	1.0	8.8	0.0	0	32
1	201	C	0	1.9	11.7	0.0	1	30
1	210	D	0	2.5	23.2	0.0	1	19
1	210	E	0	-0.7	12.9	0.0	0	29
1	210	F	0	2.0	12.6	0.0	7	23
1	210	G	0	6.2	18.1	0.1	7	26
1	220	A	0	-0.9	6.7	0.0	0	39
2	250	G	0	5.0	25.0	0.0	0	38
2	250	H	0	4.6	21.4	0.0	0	40
2	250	J	0	3.2	13.2	0.0	0	38
2	250	K	0	2.9	14.2	0.0	0	44
2	260	A	0	1.3	4.7	0.0	12	39
2	260	B	0	2.5	9.5	0.0	0	49
2	270	G	0	1.1	6.9	0.0	0	51
2	270	H	0	0.2	5.5	0.0	0	43
2	270	J	0	5.7	20.0	0.1	0	45

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.

ANOMALY LIST, LARDER LAKE NORTH

FLIGHT	LINE	ANOMALY	CATEGORY	FREQUENCY 4575 INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
2	280	A	0	18.4	39.7	0.4	0	39
2	280	B	0	1.3	7.4	0.0	0	60
2	280	C	0	1.0	8.6	0.0	0	48
2	290	E	0	8.7	26.3	0.2	0	41
2	290	F	0	10.8	30.6	0.2	0	41
2	290	G	0	1.7	8.9	0.0	0	37
2	290	H	0	7.0	14.2	0.3	0	56
2	300	A	0	14.2	36.7	0.3	0	38
2	300	B	0	2.7	12.7	0.0	0	46
2	300	C	0	2.8	20.5	0.0	0	25
2	300	D	0	2.1	16.5	0.0	0	30
2	300	E	0	10.9	31.1	0.2	0	37
2	300	F	0	13.1	38.7	0.2	0	34
2	310	D	0	5.9	17.3	0.1	0	45
2	310	E	0	9.0	22.2	0.2	0	47
2	310	F	0	2.2	10.5	0.0	0	42
2	310	G	0	1.6	11.1	0.0	0	38
2	310	H	0	5.0	13.3	0.1	0	55
2	320	A	0	5.9	23.5	0.1	0	44
2	320	B	0	1.4	6.8	0.0	12	28
2	320	C	0	2.3	10.3	0.0	0	36
2	320	D	0	5.8	16.9	0.1	0	45
2	320	E	0	9.3	30.7	0.1	0	36
2	330	C	0	5.0	13.4	0.1	0	50
2	330	D	0	5.1	13.3	0.1	0	52
2	340	A	0	9.9	33.2	0.1	0	37
2	340	B	0	9.5	25.2	0.2	0	40
2	350	A	0	4.0	10.1	0.1	0	60
2	350	B	0	5.3	14.5	0.1	0	56
2	360	A	0	3.9	14.7	0.0	0	56
2	360	B	0	3.1	15.8	0.0	0	46
2	360	C	0	5.3	23.2	0.0	0	35
2	360	D	0	5.6	24.2	0.0	0	40
2	370	C	0	5.4	21.0	0.1	0	48
2	370	D	0	5.8	22.0	0.1	0	39

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.

ANOMALY LIST, LARDER LAKE NORTH

FLIGHT	LINE	ANOMALY	CATEGORY	FREQUENCY 4575 INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
2	371	A	0	11.7	51.6	0.1	0	33
2	371	B	0	12.7	44.8	0.2	0	30
2	380	A	0	6.7	18.8	0.2	0	42
2	380	B	0	9.6	26.5	0.2	0	41
2	390	A	0	5.7	18.6	0.1	0	46
2	390	B	0	6.1	16.7	0.2	0	53
2	400	A	0	2.9	10.2	0.0	0	64
2	400	B	0	3.0	11.1	0.0	0	54
2	410	B	0	1.7	11.5	0.0	1	29
2	410	C	0	2.1	13.7	0.0	2	27
2	410	D	0	3.1	13.7	0.0	0	47
2	410	E	0	4.4	14.3	0.1	0	49
2	420	A	0	3.6	12.8	0.1	0	43
2	420	B	0	4.2	17.9	0.0	0	50
2	420	C	0	2.6	15.9	0.0	3	25
2	420	D	0	2.8	18.2	0.0	0	33

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.

ANOMALY LIST, LARDER LAKE SOUTH

FLIGHT	LINE	ANOMALY	CATEGORY	FREQUENCY 4575 INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
1	40	A	0	2.6	11.9	0.0	0	37
1	50	A	0	2.0	9.0	0.0	2	36
1	60	A	0	2.1	7.3	0.0	9	34
1	80	A	0	10.7	11.7	0.9	19	30
1	100	A	0	10.0	22.0	0.3	9	25
1	110	A	0	13.0	16.8	0.7	14	28
1	120	A	0	6.7	9.0	0.5	19	33
1	130	A	0	2.2	12.0	0.0	5	26
1	140	B	0	1.6	8.2	0.0	0	42
1	150	A	0	2.4	14.0	0.0	1	28
1	150	B	0	2.7	16.2	0.0	0	31
1	160	B	0	3.0	15.9	0.0	0	34
1	160	C	0	1.9	14.5	0.0	0	33
1	170	A	0	3.6	17.9	0.0	6	22
1	180	C	0	2.7	12.1	0.0	0	34
1	190	A	0	4.8	16.6	0.1	5	27
1	190	B	0	0.9	4.2	0.0	16	32
1	190	C	0	5.1	17.2	0.1	6	27
1	201	D	0	3.1	11.8	0.0	9	26
1	201	E	0	0.7	5.8	0.0	2	34
1	201	F	0	8.4	29.9	0.1	0	29
1	210	A	0	6.3	21.9	0.1	0	30
1	210	B	0	1.0	10.9	0.0	0	28
1	210	C	0	3.2	13.0	0.0	14	20
1	220	B	0	1.1	12.1	0.0	0	38
1	220	C	0	0.8	9.2	0.0	0	27
1	220	D	0	10.1	36.3	0.1	1	24
1	220	E	0	6.8	31.7	0.0	2	22

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.

ANOMALY LIST, LARDER LAKE SOUTH

FLIGHT	LINE	ANOMALY	CATEGORY	FREQUENCY 4575 INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
2	230	A	0	10.6	27.2	0.2	0	36
2	230	B	0	12.2	35.3	0.2	0	28
2	230	C	0	2.8	10.6	0.0	8	30
2	230	D	0	1.8	9.1	0.0	0	43
2	230	E	0	3.8	5.5	0.3	6	55
2	240	A	0	5.1	12.7	0.2	0	51
2	240	B	0	1.4	8.0	0.0	0	48
2	240	C	0	2.1	10.7	0.0	0	39
2	250	A	0	8.7	27.1	0.2	2	27
2	250	B	0	8.0	25.8	0.1	1	28
2	250	C	0	4.5	18.0	0.0	5	25
2	250	D	0	1.2	6.2	0.0	0	48
2	250	E	0	11.2	27.5	0.3	0	43
2	250	F	0	11.4	35.5	0.2	0	37
2	250	G	0	5.0	25.0	0.0	0	38
2	260	C	0	6.9	16.1	0.2	0	53
2	260	D	0	8.7	20.5	0.2	0	54
2	260	E	0	0.9	6.8	0.0	0	49
2	260	F	0	2.2	12.4	0.0	0	37
2	260	G	0	6.7	26.3	0.1	0	43
2	260	H	0	7.8	29.3	0.1	0	41
2	270	A	0	9.1	41.7	0.1	0	27
2	270	B	0	12.6	48.8	0.1	0	28
2	270	C	0	7.0	34.2	0.0	1	22
2	270	D	0	1.7	11.6	0.0	0	44
2	270	E	0	4.5	15.9	0.1	0	51
2	270	F	0	12.7	36.3	0.2	0	43
2	280	D	0	6.0	18.9	0.1	0	48
2	280	E	0	3.5	18.3	0.0	0	30
2	280	F	0	4.4	15.9	0.1	0	33
2	290	A	0	5.4	22.3	0.1	0	31
2	290	B	0	2.2	10.4	0.0	3	32
2	290	C	0	2.7	7.4	0.1	0	56
2	290	D	0	9.8	35.3	0.1	0	36
2	300	G	0	6.0	20.4	0.1	0	40
2	300	H	0	3.3	9.1	0.1	0	54
2	300	J	0	1.1	11.1	0.0	0	36

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.

ANOMALY LIST, LARDER LAKE SOUTH

FLIGHT	LINE	ANOMALY	CATEGORY	FREQUENCY 4575 INPHASE	QUAD.	CONDUCTOR CTP MHOS	DEPTH MTRS	BIRD HEIGHT MTRS
2	300	K	0	2.2	12.6	0.0	0	35
2	310	A	0	5.5	20.1	0.1	0	29
2	310	B	0	1.4	11.5	0.0	0	28
2	310	C	0	3.8	6.9	0.2	15	38
2	320	F	0	5.9	15.8	0.2	0	43
2	330	A	0	8.5	16.7	0.3	6	32
2	330	B	0	7.1	15.5	0.2	0	44
2	340	C	0	6.1	17.2	0.1	0	40
2	340	D	1	16.0	14.2	1.4	9	37
2	360	E	0	12.9	22.6	0.5	0	38
2	370	A	0	12.3	18.5	0.6	0	41
2	370	B	0	4.2	17.6	0.0	1	29
2	380	C	0	7.3	14.8	0.3	0	54
2	410	A	0	6.4	28.6	0.1	5	20
2	420	E	0	3.8	17.7	0.0	0	39
2	420	F	0	8.3	38.6	0.1	0	36

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.

W8408.00213 ~~E1672~~

Ministry of Natural Resources Ontario

Report of Work
(Geophysical, Geological, Geochemical and Expenditures) W8408

32D04NE0084 2.7215 MCVITTIE 900

Lands Management.

Type of Survey(s): Airborne Geophysical	Township or Area: McVittie Twp
Claim Holder(s): Luc Minerals Ltd	Prospector's Licence No.: T-664
Address: Ste 2105, North Tower, Royal Bank Plaza Toronto	
Survey Company: Aerodat Ltd	Date of Survey (from & to): 30 06 84 (Day Mo. Yr.) – 30 06 84 (Day Mo. Yr.); Total Miles of line Cut: 345 Km (air)
Name and Address of Author (of Geo-Technical report): Scott Hogg 3883 Nashua Dr Mississauga L4V 1R3	

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)	- Radiometric	
	- Other	
	Geological	
	Geochemical	

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

Airborne Credits		Days per Claim
Note: Special provisions credits do not apply to Airborne Surveys.	Electromagnetic (Input)	30
	Magnetometer	30
	Radiometric	20

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.

Date	Recorded Holder or Agent (Signature)
July 20/84	Chris Pegg

Mining Claims Traversed (List in numerical sequence)

Mining Claim Prefix	Number	Expend. Days Cr.	Mining Claim Prefix	Number	Expend. Days Cr.
L	see attached List				

RECEIVED JUL 27 1984 MINING LANDS SECTION

LARDER LAKE MINING DIV. RECEIVED JUL 20 1984 AM PM 7 8 9 10 11 12 1 2 3 4 5 6

Total number of mining claims covered by this report of work. 153

For Office Use Only

Total Days Cr. Recorded	Date Recorded	Mining Recorder
12,240	JUL 20 1984	[signature]
	Date Approved as Recorded: 84.10.??	Branch Director: [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
Chris Pegg P.O. Box 670 91 Duncan Ave South
Kirkland Lake Ont P2N 3K2

Date Certified	Certified by (Signature)
July 20/84	Chris Pegg

1362 (81/9)

Lac Minerals McVittie Township Claim List

L 767391
L 767392
L 767393
L 767394
L 767395
L 767396
L 767397
L 767398
L 767399
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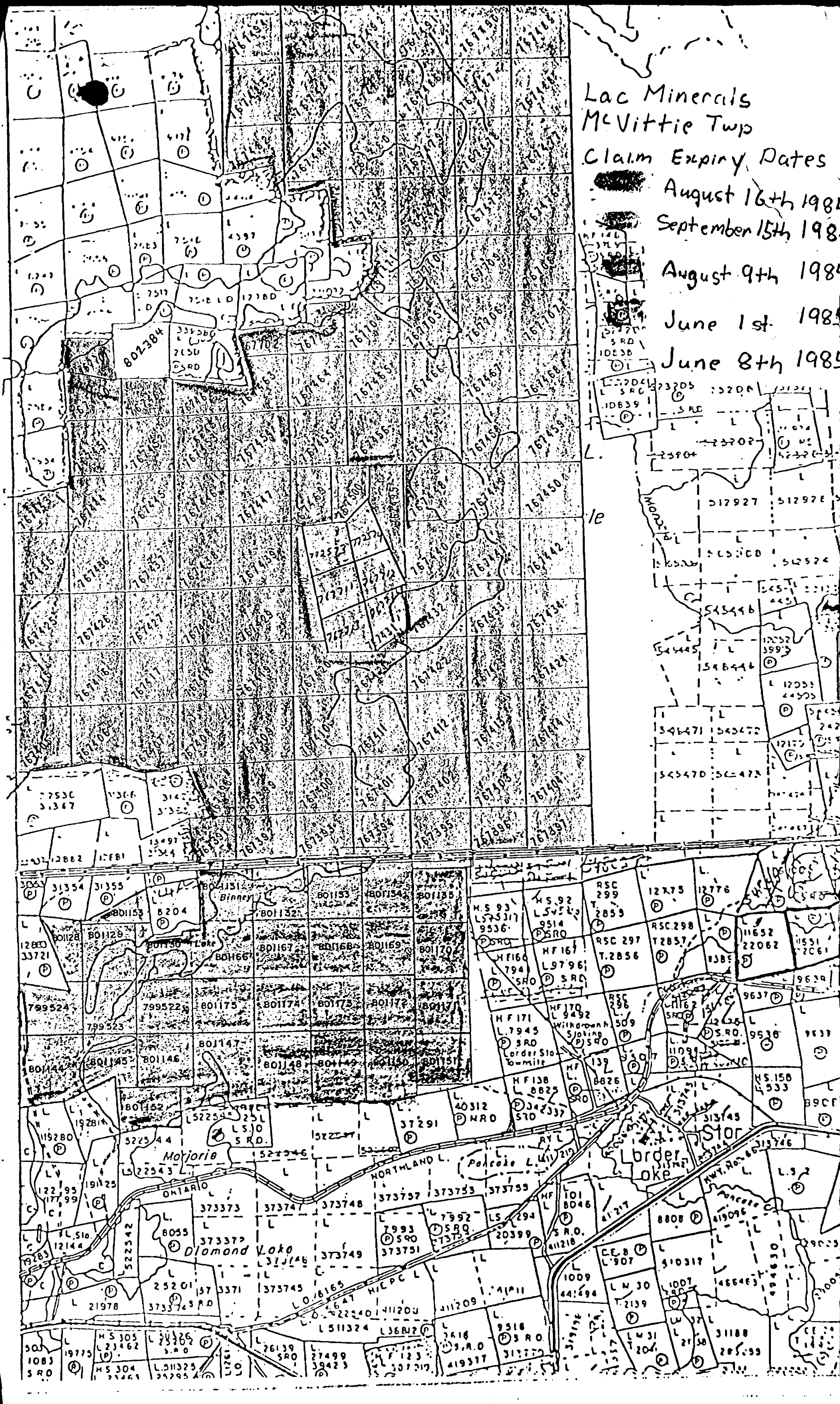


Lac Minerals
McVittie Twp
Claim Expiry Dates
August 16th 198
September 15th 198
August 9th 198
June 1st 198
June 8th 198
Binney
Lake
Marjorie
Ontario
Northland
Diamond Lake
Larder Lake

Mining Lands Section

File No 27215

Control Sheet

TYPE OF SURVEY

✓ GEOPHYSICAL

_____ GEOLOGICAL

_____ GEOCHEMICAL

_____ EXPENDITURE

MINING LANDS COMMENTS:

Lgd. L.D.

Signature of Assessor

Oct. 29/84.

Date

1984 10 10

Your File: 273
Our File: 2.7215

Mining Recorder
Ministry of Natural Resources
4 Government Road East
Kirkland Lake, Ontario
P2N 1A2

Dear Sir:

We received reports and maps on September 24, 1984 for an Airborne Geophysical (Electromagnetic, Magnetometer and Radiometric) Survey submitted on Mining Claims L 767391 et al in the Township of McVittie.

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

Yours sincerely,

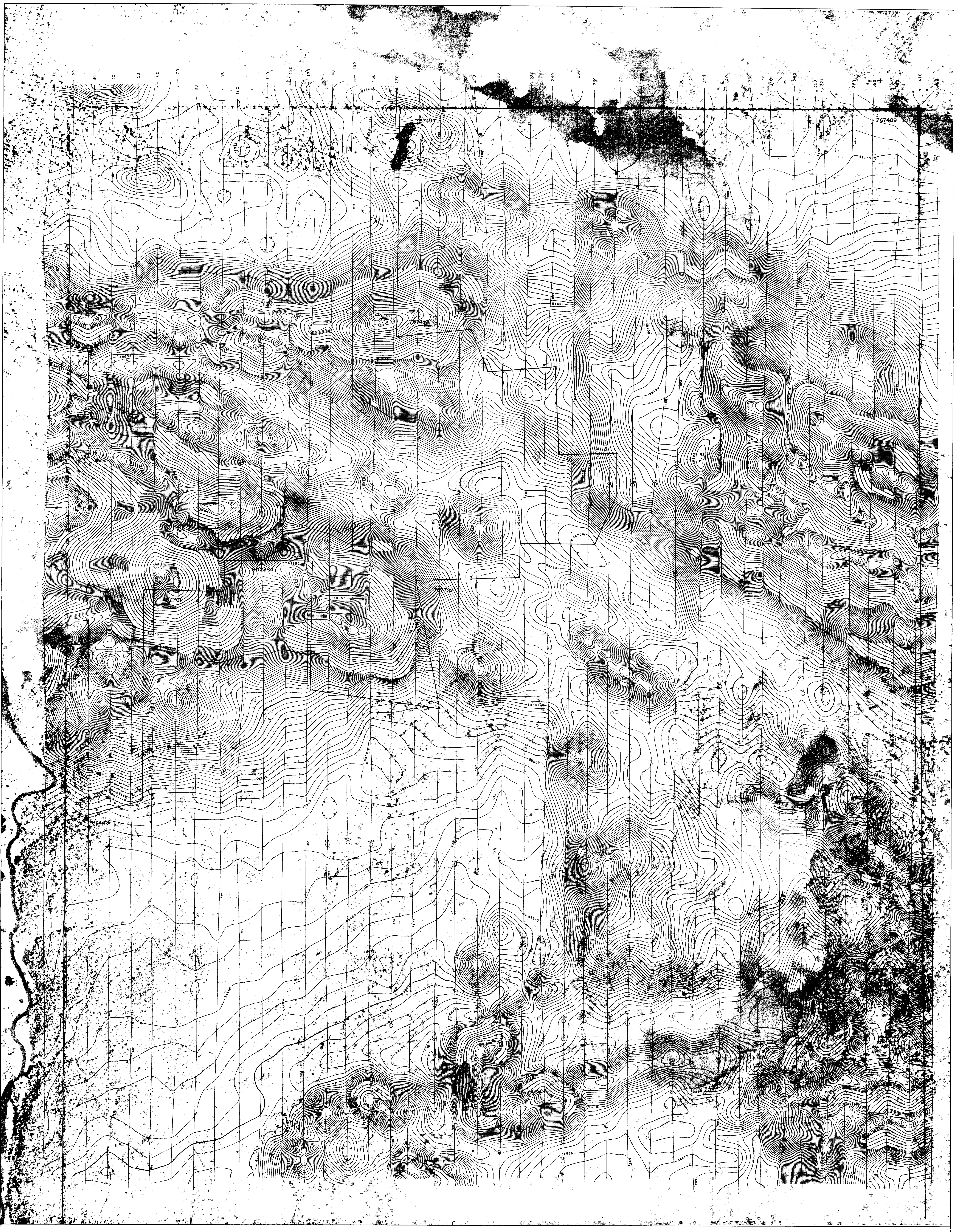
S.E. Yundt
Director
Land Management Branch

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

A. Barr:sc

cc: Lac Minerals Limited
Ste 2105
North Tower
Royal Bank Plaza
Toronto, Ontario
M5J 2J4

cc: Lac Minerals Limited
91 Duncan Avenue South
Kirkland Lake, Ontario
P2N 3L1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767489
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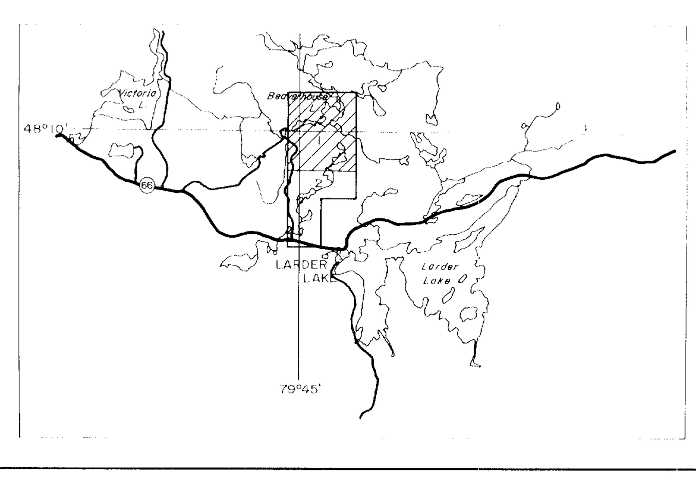
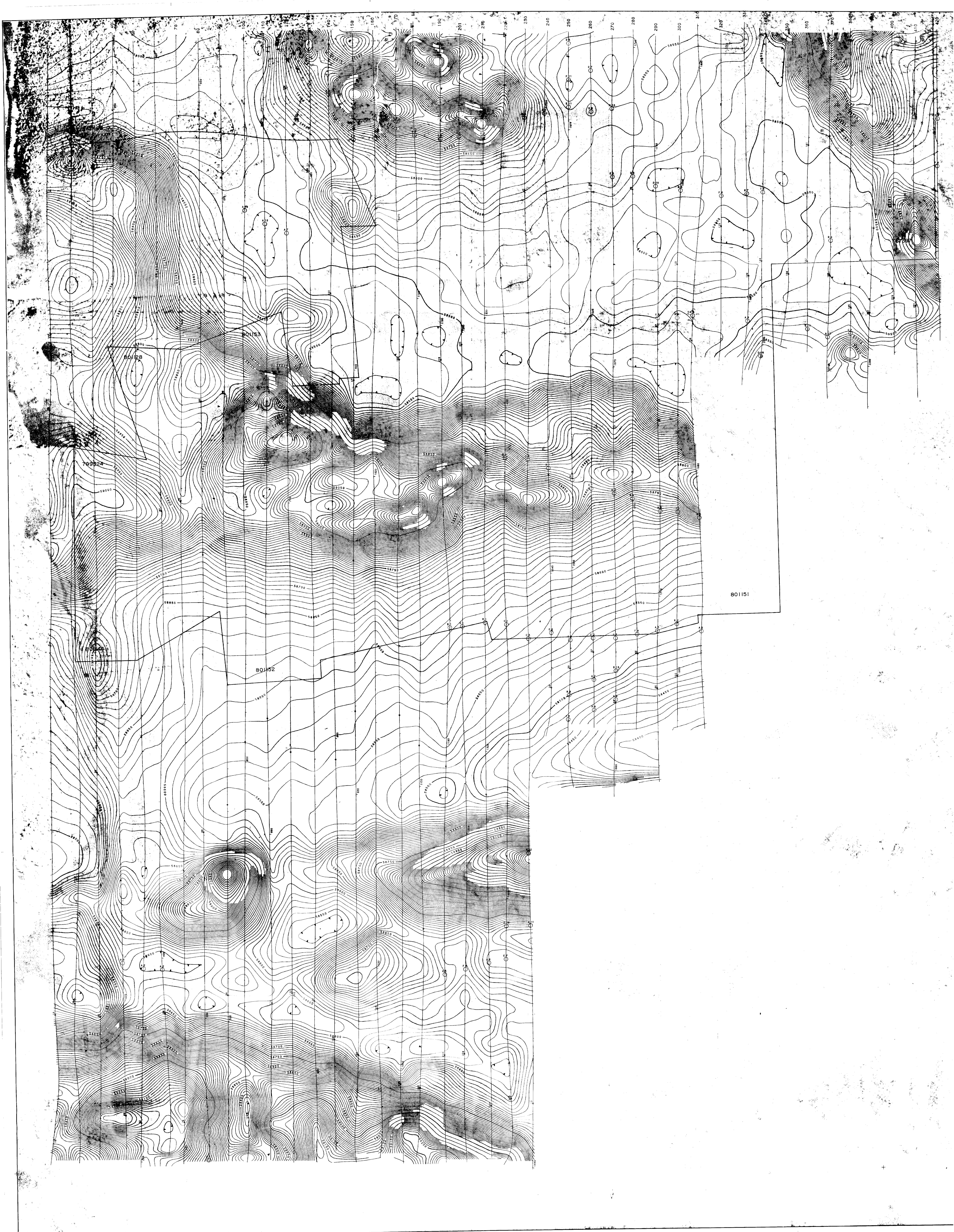
767702


LAC MINERALS LIMITED
TOTAL FIELD MAGNETIC MAP
McVITTIE TOWNSHIP
ONTARIO
SCALE 1/4800
660
400 metres
DATE June 1984
▼ AERODAT LIMITED
N.T.S. No: 32 D
MAP No: 3



LAC MINERALS LIMITED

TOTAL FIELD MAGNETIC MAP

McVITTIE TOWNSHIP

ONTARIO

SCALE 1/4800

330 Feet 0 660 1320 Feet

100 metres 0 100 200 300 400 metres

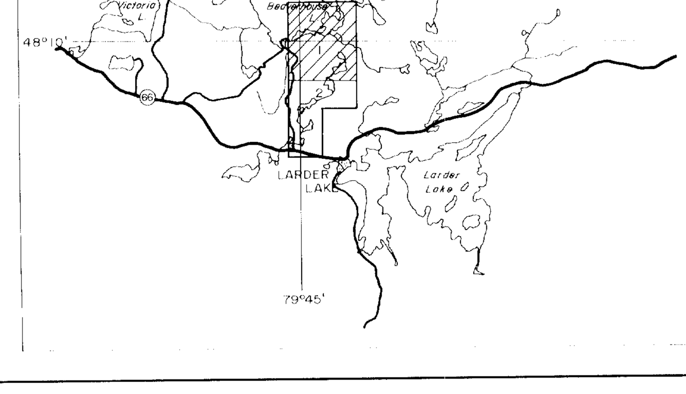
▼AERODAT LIMITED

DATE: June 1984

N.T.S. No: 32 D

MAP No: 3

210



LAC MINERALS LIMITED

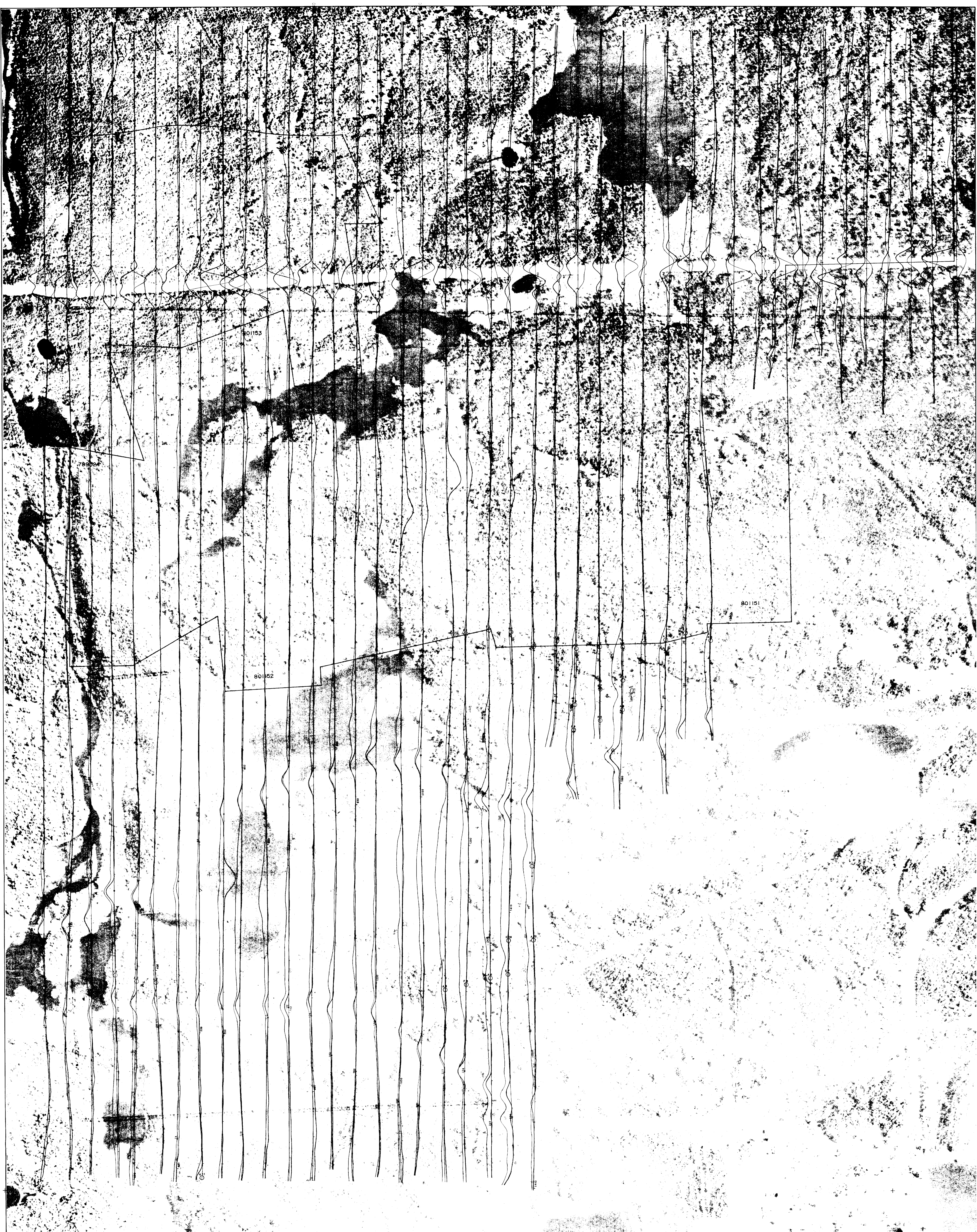
AIRBORNE ELECTROMAGNETIC SURVEY
PROFILES – 932 Hz (coaxial)

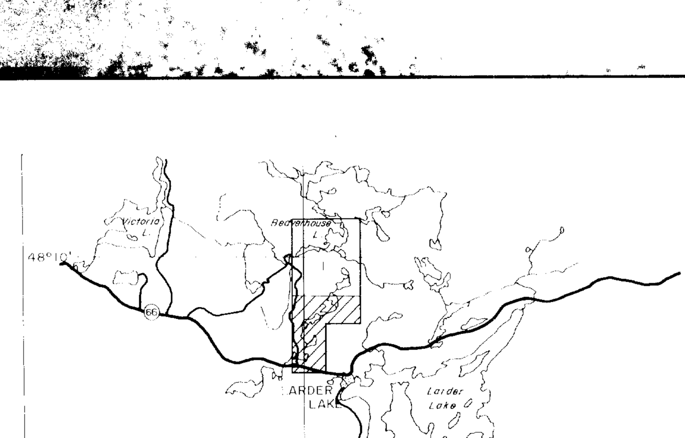
McVITTIE TOWNSHIP
ONTARIO

SCALE 1/4800

▼ **AERODAT LIMITED**

DATE	June 1984
N.T.S. No	32 D
MAP No	2





LAC MINERALS LIMITED

AIRBORNE ELECTROMAGNETIC SURVEY
PROFILES – 932 Hz (coaxial)

McVITTIE TOWNSHIP

ONTARIO

SCALE 1/4800

DATE:	June 1984
N.T.S. No:	32 D
MAP No:	2

▼ **AERODAT LIMITED**

230


767494
767489
767482
802384
767701
767702
767443
EM Anomaly A, in-phase amplitude 7 p.p.m.
Conductivity thickness range 2 (see code)
Interpreted bedrock conductor axis
Possible bedrock conductor axis
Ct
Cultural conductor
EM RESPONSE
Conductivity thickness in mhos
60-120
30-60
15-30
8-15
4-8
2-4
1-2
0-1
Horizontal control .... MRS III
Average bird height .... 30 metres
Line spacing .... 100 metres
AERODAT HEM SYSTEM RESPONSE
VERTICAL HALF-PLANE
QUADRATURE (ppm)
IN-PHASE (ppm)
LAC MINERALS LIMITED
AIRBORNE ELECTROMAGNETIC SURVEY
INTERPRETATION MAP
McVITTIE TOWNSHIP
ONTARIO
SCALE 1/4800
660
1320 Feet
100 metres
0
100
200
300
400 metres
▼ AERODAT LIMITED
DATE: June 1984
N.T.S. No: 32 D
MAP No: 1

240

- EM Anomaly A, in-phase amplitude 7 p.p.m. Conductivity thickness range 2 (see code)
- Interpreted bedrock conductor axis
- Possible bedrock conductor axis
- Ct — Cultural conductor

EM RESPONSE

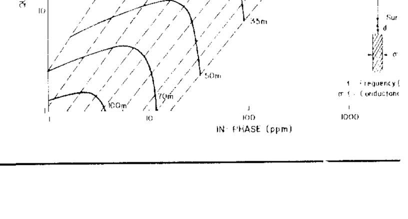
Conductivity thickness in mhos

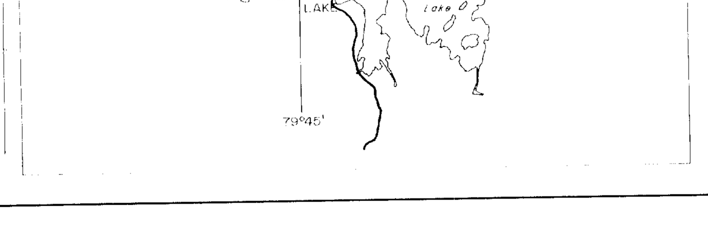
⑦	60-120
⑥	30-60
⑤	15-30
④	8-15
③	4-8
②	2-4
①	1-2
○	0-1

Horizontal control .... MRS III

Average bird height .... 30 metres

Line spacing .... 100 metres





LAC MINERALS LIMITED

AIRBORNE ELECTROMAGNETIC SURVEY INTERPRETATION MAP

McVITTIE TOWNSHIP

ONTARIO

SCALE 1/4800

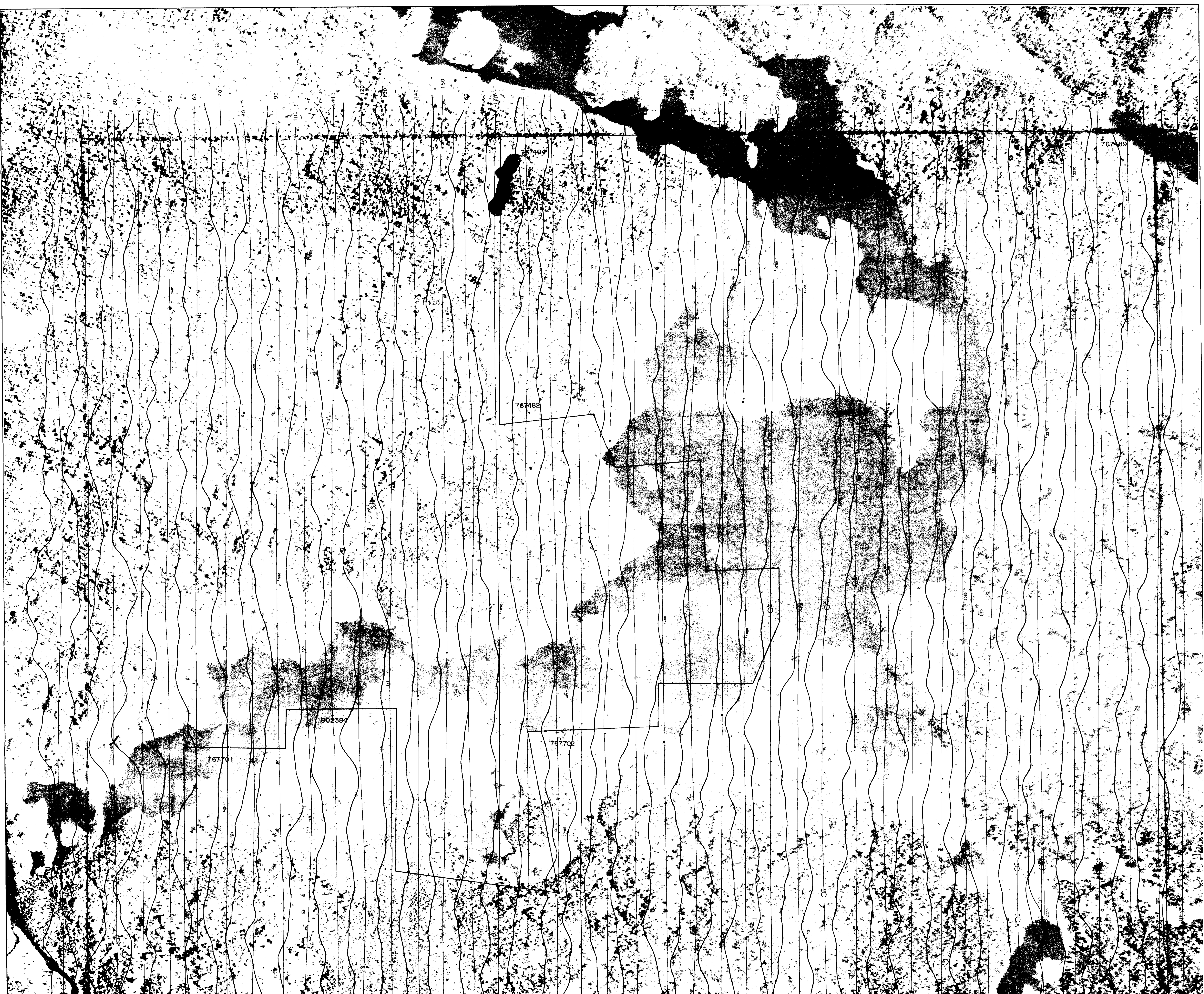
▼ AERODAT LIMITED

DATE: June 1984

N.T.S. No: 32 D

MAP No: 1

250



Legend - 0.5 cps /mm

LAC MINERALS LIMITED

THORIUM PROFILES

McVITTIE TOWNSHIP

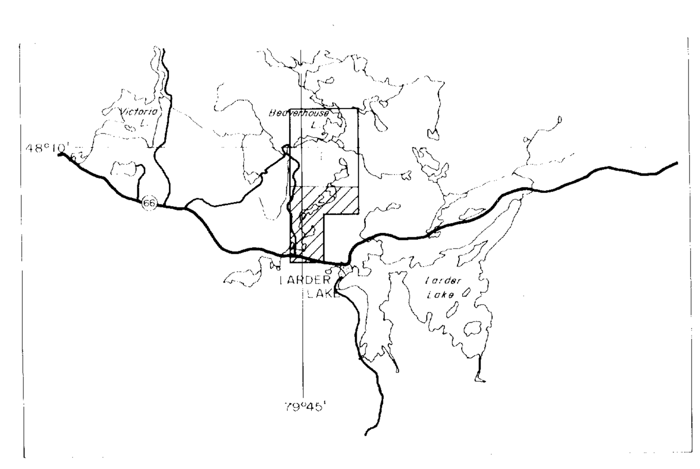
ONTARIO

SCALE 1/4800

DATE	June 1984
N.T.S. No	32D
MAP No	5

▼ AERODAT LIMITED

Legend – 0.5 cps/mm



LAC MINERALS LIMITED

THORIUM PROFILES

McVITTIE TOWNSHIP

ONTARIO

SCALE 1/4800

100 metres 0 100 200 300 400 metres

▼ AERODAT LIMITED

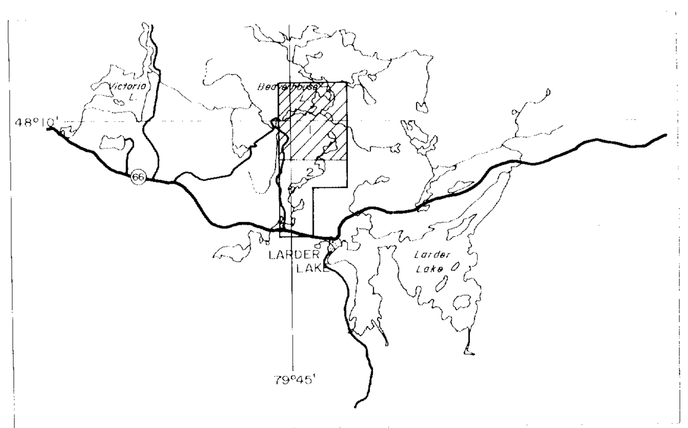
DATE: June 1984

N.T.S. No: 32D

MAP No: 5

270

Legend : 2.5 cps/mm



LAC MINERALS LIMITED

POTASSIUM PROFILES

McVITTIE TOWNSHIP

ONTARIO

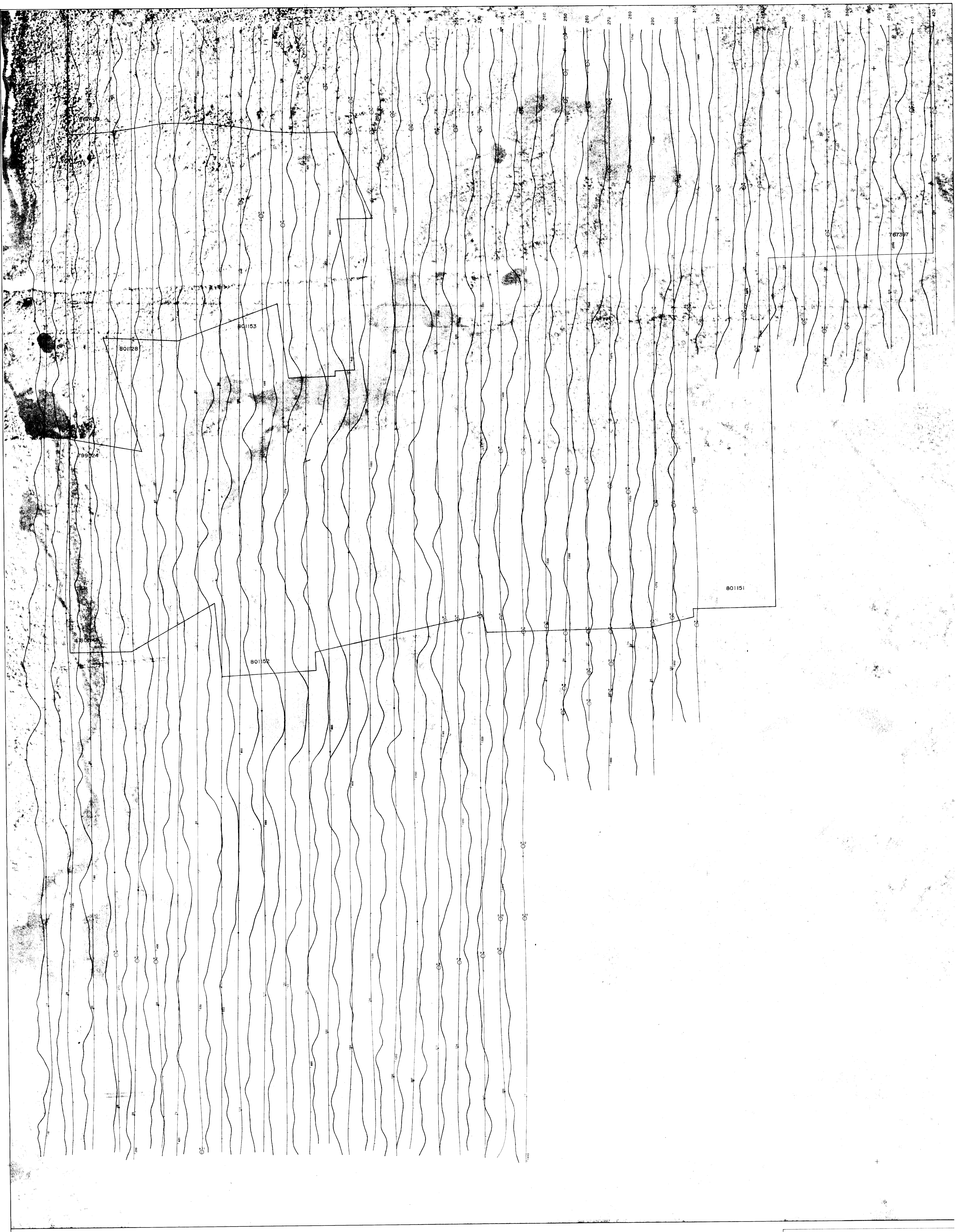
SCALE 1/4800

▼ AERODAT LIMITED

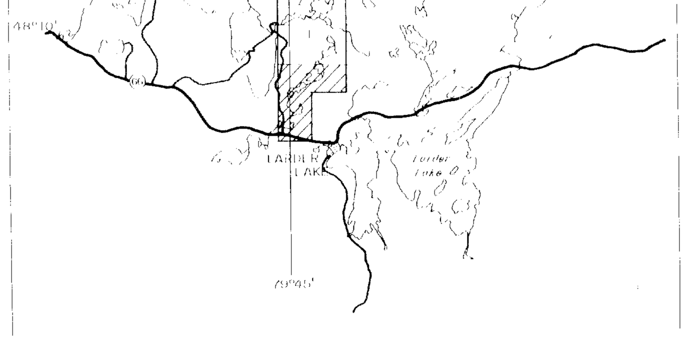
DATE: June 1984

N.T.S. No: 32 D

MAP No: 6



Legend – 2.5 cps /mm



LAC MINERALS LIMITED

POTASSIUM PROFILES

McVITTIE TOWNSHIP

ONTARIO

SCALE 1/4800

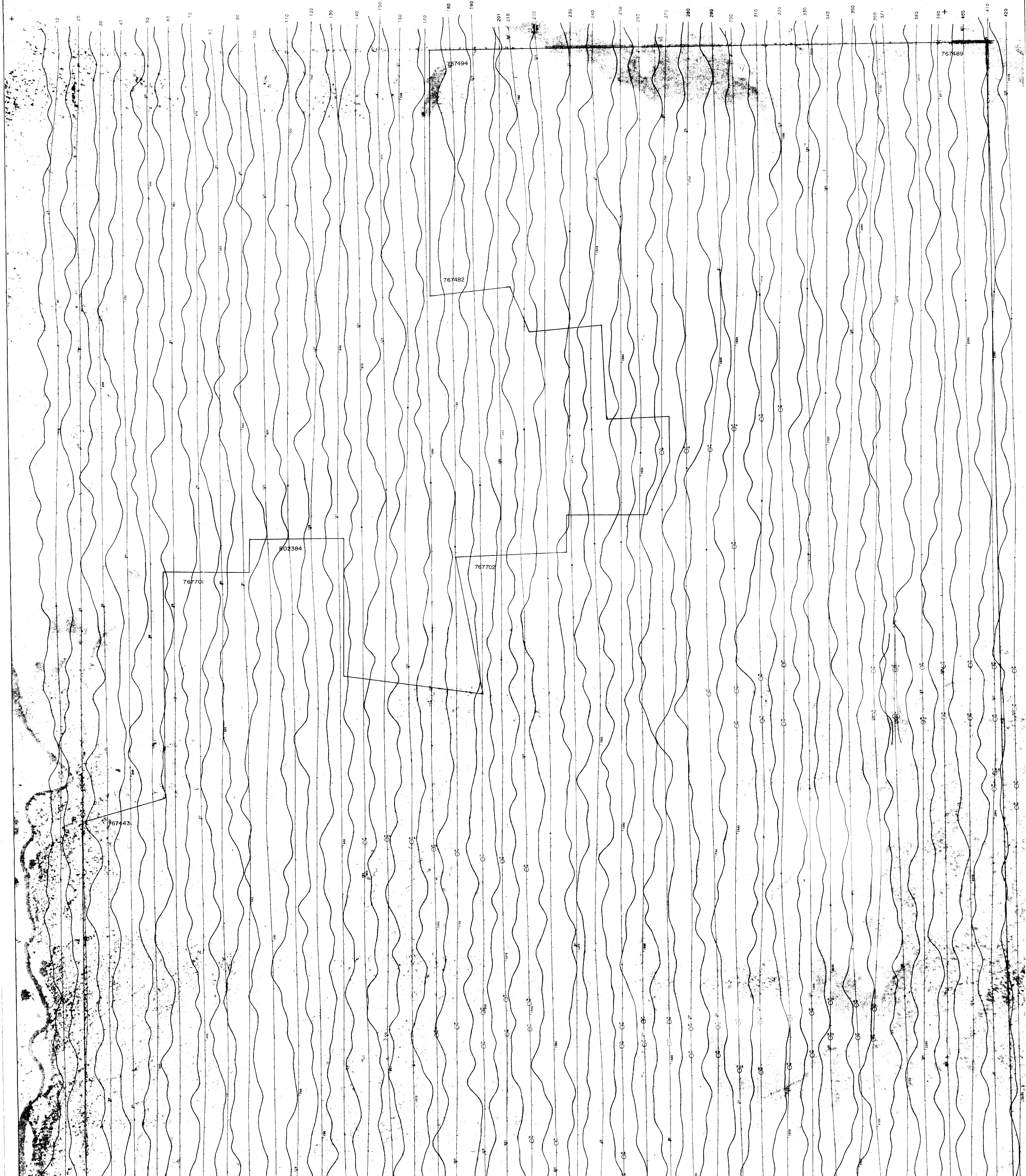
▼ AERODAT LIMITED

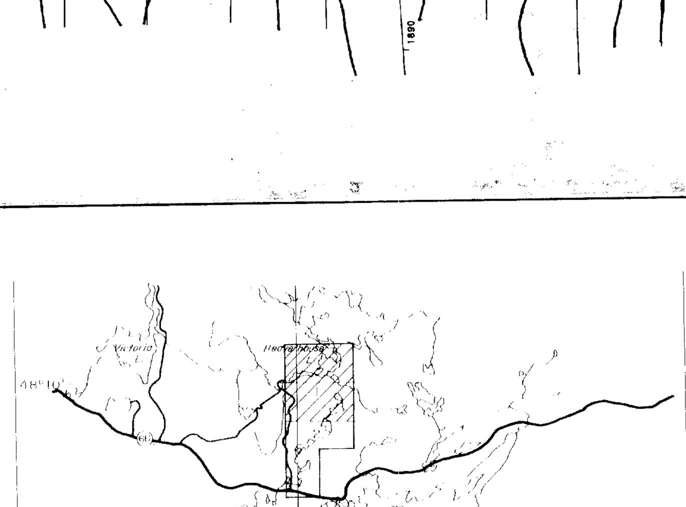
DATE: June 1984

N.T.S. No: 32 D

MAP No: 6

290





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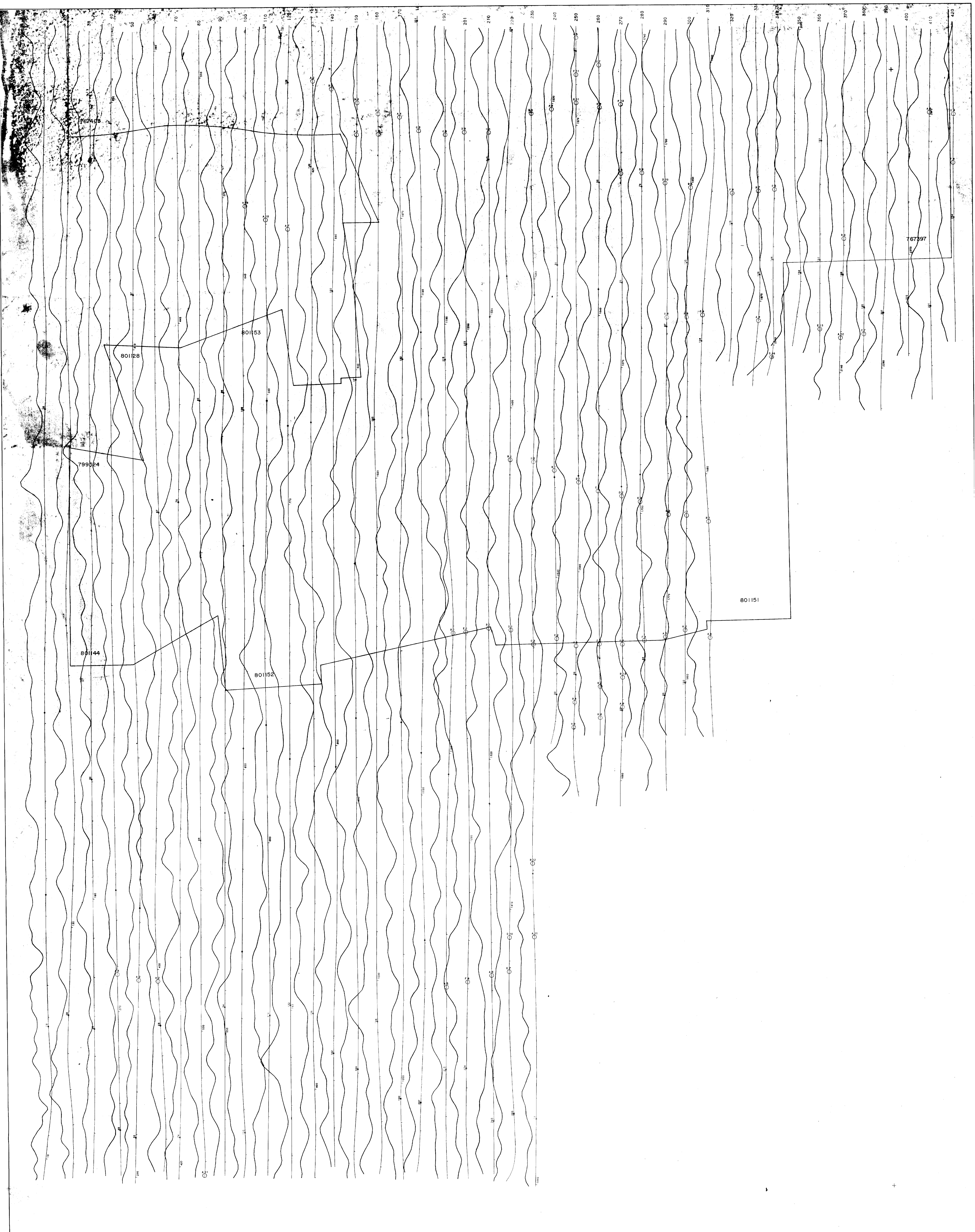

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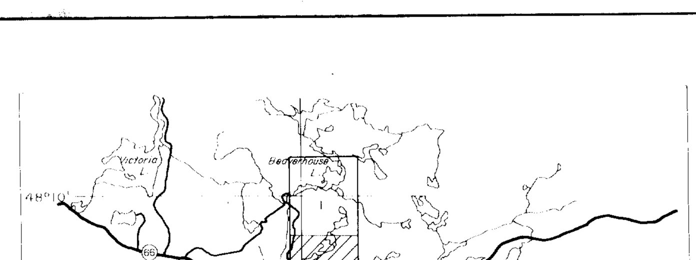

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