Geophysics Processing Report: Frenchvale DCIP

Prepared on March 1st, 2025, by:

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1 INTRODUCTION

21Alpha Resources Inc. contracted GeoXplore Surveys Inc. to conduct a Direct Current Resistivity and Induced Polarization (DCIP) survey on the Frenchvale property area in Cape Breton, Nova Scotia Canada. The Frenchvale property is located in the Boisdale hills in Frenchvale, Nova Scotia approximately 25 kilometers west of the Sydney on NTS sheets 011K/01. The survey was conducted over mineral license 54489 (Figure 1). The property contains promising indicators of economically viable mineral deposits (Wightman 2011)., with geologic features that warrant investigation using DCIP survey methods as recommended by Dubé, 2017.

The objectives of the survey were to further establish and expand upon the findings of previous surveys and geologic information. The survey consisted of 7 lines, up to 1000 m long, spaced 50 to 100 m apart in the Pole-Dipole configuration with an a-spacing of 25 m and a n from 1 to 6. The lines were oriented137-327°. The survey amounted to 6.85-line kilometers of data collected between the dates of February 11th to February 17th, 2025.

This report details the survey logistics, data acquisition parameters, quality control and assurance (QAQC), data processing, and final products delivered digitally with this report.

Figure 1: Grid general location in Nova Scotia (OpenStreet Map)

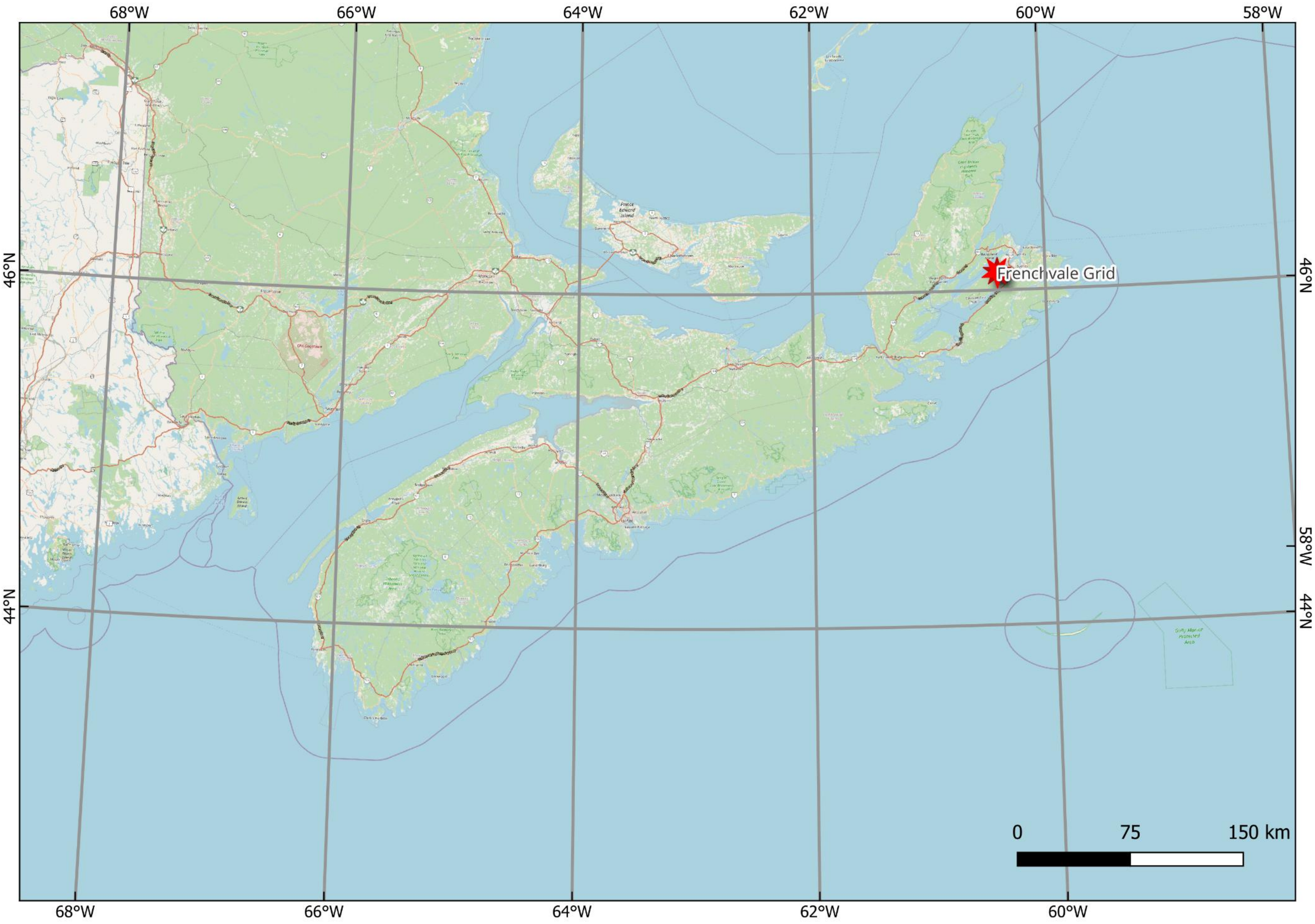
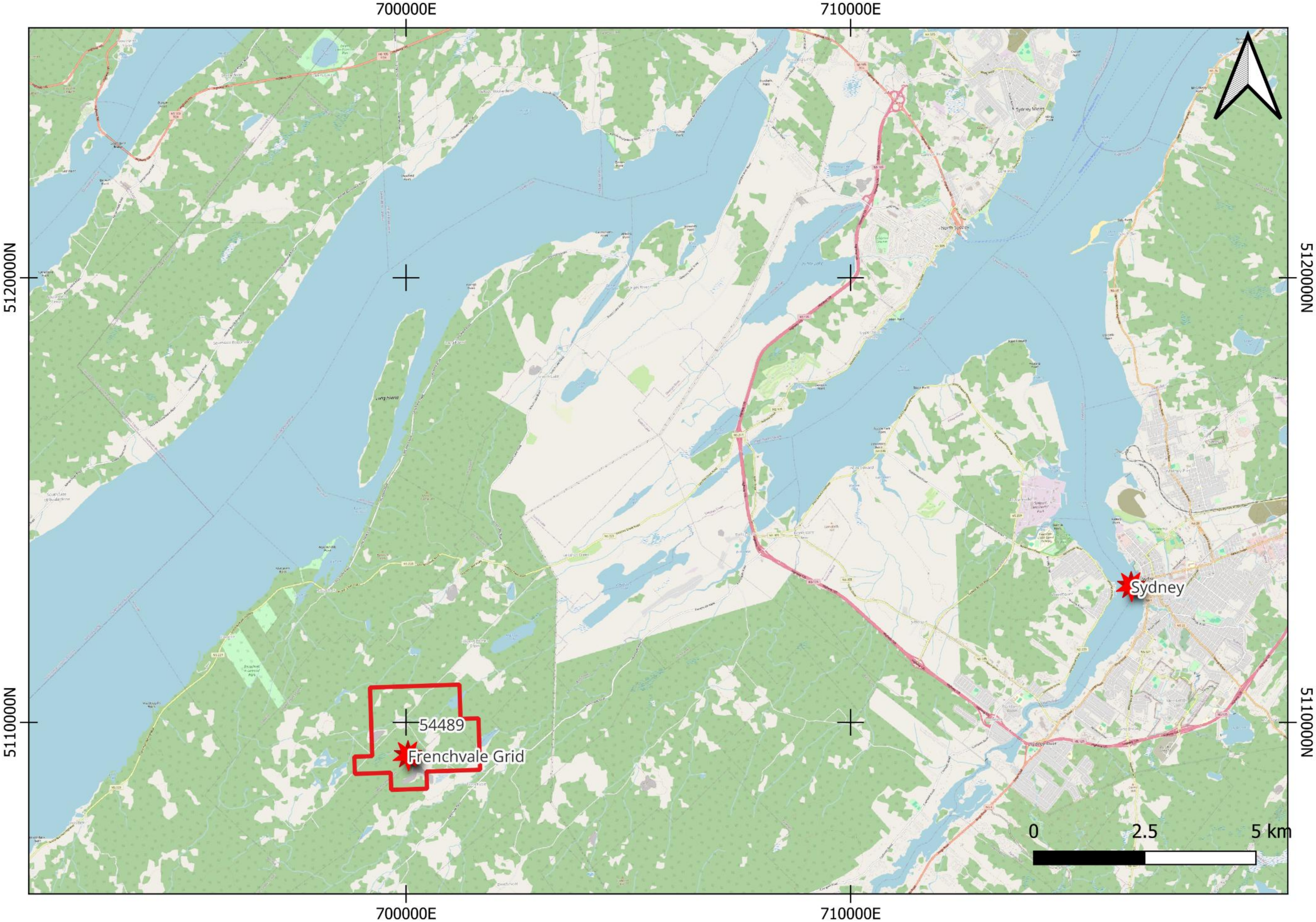


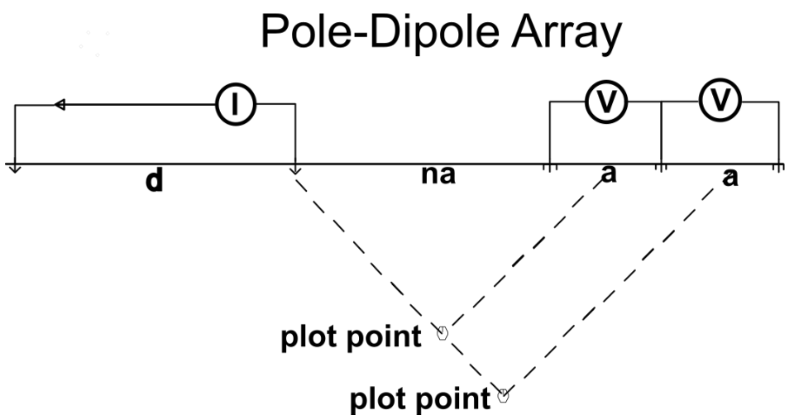
Figure 2: Grid Location From Sydney, Cape Breton, Nova Scotia



2 SURVEY THEORY

The purpose of DCIP surveys is to determine the electrical properties of the subsurface and map discontinuities, with the two most common measurements being resistivity and chargeability. A DCIP survey is carried out using a set of potential and current electrodes, and the depth of investigation is determined by the ground conductivity and electrode distribution. Electrode distributions that are more spread out have a deeper depth of investigation. A typical arrangement is set up using four electrodes: two current and two potentials. The apparent resistivity is calculated using the current from the current electrodes, the potential difference between the potential electrodes, and the geometric factor based on the electrode distribution.

Figure 2: Schematic of pole dipole array. d is a distance away from the array much greater than the length of the array, a is the electrode spacing and n is an integer multiple.



ρ is the apparent resistivity and φ is the potential difference between receiver electrodes k is the geometric factor. r is the distance between electrodes, C# is the current electrode and P# is the potential electrode.

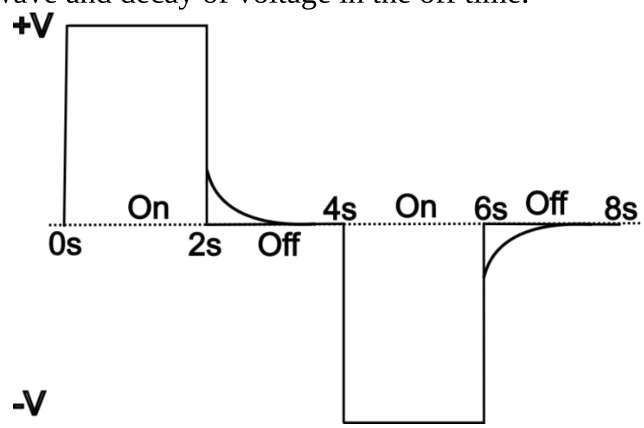
$$\rho = k\frac{\Delta\varphi}{I}$$

$$k = \frac{2\pi}{\frac{1}{r_{C1P1}} - \frac{1}{r_{C2P1}} - \frac{1}{r_{C1P2}} - \frac{1}{r_{C1P2}}}$$

The Induced Polarization effect is cause by polarization and charge build up at boundaries of pore spaces or metallic minerals. During the on time for the current electrode's, minerals or pore spaces will become polarized due to the current that is passed through them and when the current is turned off (off time) the minerals dissipate this charge to return to equilibrium. This is measured at the potential electrodes and the area under the decay curve can be calculated and compared to chargeability values of known minerals to determine areas of interest. M is the chargeability, V_c is the on-time voltage and V(t) is the residual voltage during the off time between a selected time window.

$$M = \frac{1}{V_c}\int_{t_1}^{t_2} V(t)dt$$

Figure 3: Transmitted wave and decay of voltage in the off time.



Current travels through the subsurface as a somewhat hemispherical shape depending on the geology of the area. This means that as spacing of an electrode array increases the depth of investigation increases but is still sensitive to the materials above, below and around it and is required to be inverted to determine a model that gives a response comparable to the measured values to delineate or increase the contrast in anomalies.

3 SURVEY PARAMETERS AND LOGISTICS

DCIP survey crews can operate with a minimum of four personnel: one transmitter operator, one receiver operator, and two field assistants. Table 1 lists the personnel involved in the survey and their respective positions.

Table 1: Personal and positions

Personal	Position
Kyle Landry	Field Crew Manager Receiver operator
Nathan White	Transmitter Operator
Alex Cameron	Field Assistant
Ryan Dunn-Daye	Field Assistant
John Shurko	Field Assistant
Andrew Hamilton	Field Assistant
Benjamin Lysak	Data Processing and QAQC

The survey was conducted using a GDD Model Tx4 IP transmitter and a GDD Model GRx8-16 IP receiver, specifications for the equipment is listed in Appendix 2. The electrodes for the transmitter and receivers were stainless steel and the wiring was 12-gauge wire for the transmitter electrodes, 18-gauge wire for the receiver electrodes. The survey was carried out using the Pole-Dipole configuration. The survey had an a spacing of 25 m and a n of 6. The profiles were completed using the roll along technique.

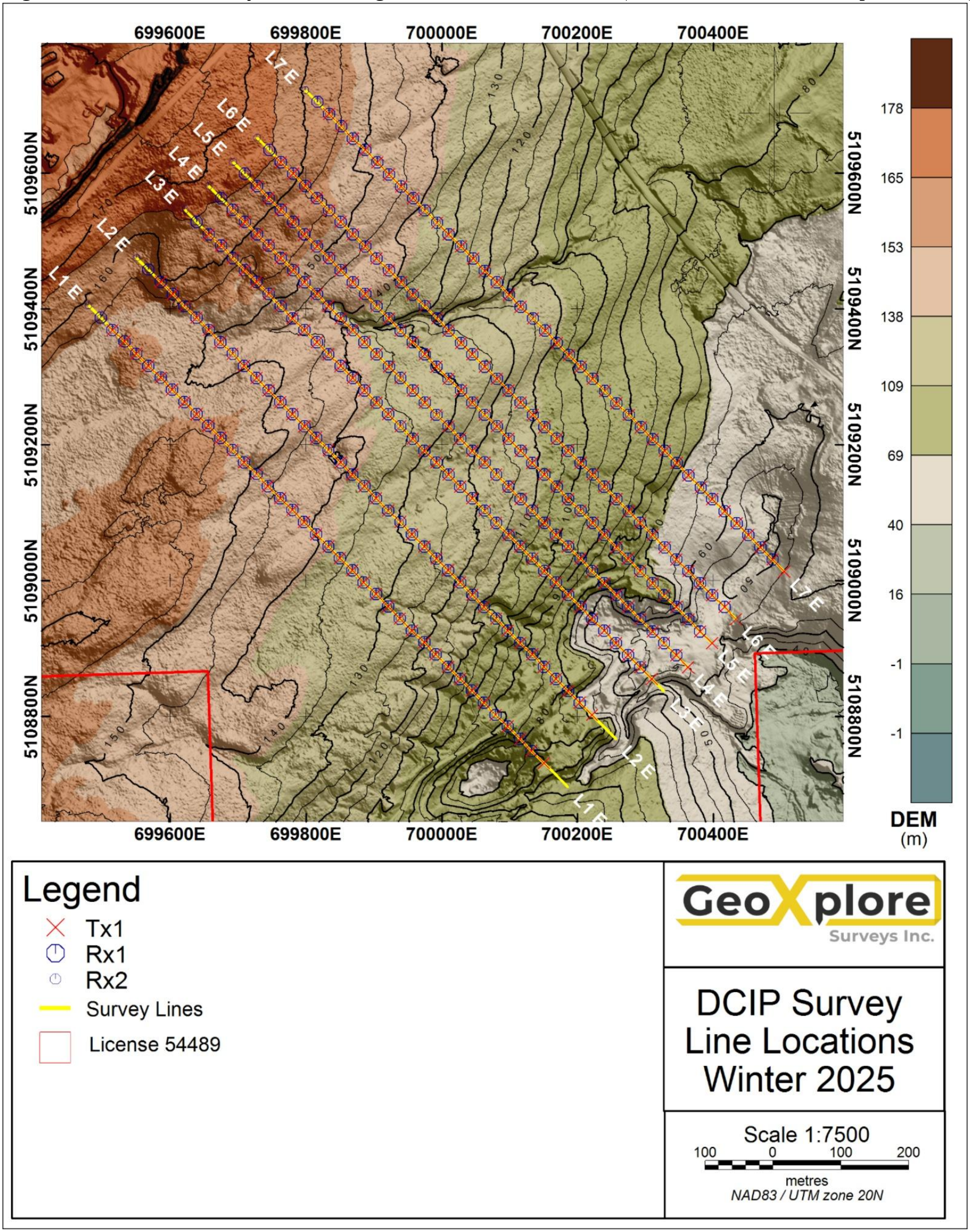
The GDD Model Tx4 IP transmitter output a square wave signal with an 8-second period on a 50% duty cycle (2 seconds on positive, 2 seconds off, 2 seconds on negative, and 2 seconds off). The GDD Model GRx8-16 IP receiver measured the primary voltage and chargeability, with the primary voltage measured during the on-time and the chargeability measured during the off-time. The off-time measurements were made using 20 windows, logarithmically spaced, with the first window starting 30 ms after the current was turned off. Chargeability was calculated from 55 ms to 1090 ms. Contact resistance ranged from 0.5 to 33.8 KOhms with an average of 9.8 KOhms. The transmitter current ranged between 160 to 965 milli-Amperes and in resistivity measured range values from 0.4 to 5682.45 Ohms.

The survey consisted of 7 lines, up to 1000 m long, spaced 50-100 m apart, and oriented 137/327 degrees. The total length of the surveyed lines was 6.85-line kilometers. Figure 4 illustrates the location and layout of the survey lines. Table 2 provides an overview of the survey details, including the number of stations, line length, and spacing.

Table 2: Survey details.

Lines	Line Length (m)	Line Spacing (m)	Line Orientation (degrees)	Survey Direction	Infinity Location UTM Z20
L1, L2	950	100	137/327	South-east to North-west	5107409N 699910E
L3-6	975-1000	50	137/327	South-east to North-west	5107409N 699910E
L7	1000	100	137/327	South-east to North-west	5107409N 699910E

Figure 4: Frenchvale Survey Lines and digital elevation model 2025 (Nova Scotia Elevation Explorer DEM)



4 DATA PROCESSING

The data is first checked during the survey using the handheld receiver to check the wave forms and signals on the different channels for repeatability and noise error during stacks. At the end of the day the data is loaded into GDD IP post process software and the raw data is checked and noisy readings in stacks are removed. After the raw data has been checked the stacked data is then loaded into Geosoft and georeferenced then geometric factors are recalculated along with apparent resistivity values. The DCIP data bases were georeferenced to North American Datum 83 Zone 20 (EPSG 26920). The data is then exported into RES2DINV to carry out the inversions. Post inversions the data is then QAQCed again in Res2dinv for noise. Then imported back into Geosoft for plotting and display.

RES2DINV uses a cell-based method to carry out the inversion to determine a model that fits the measured values using finite-element method Loke et al. (1996-2004**)**. The inversion process iterates until either a set number of inversions have been completed or until the inversion values change less than a specified value between iterations. The mesh models created in RES2DINV based on the distribution of points of the pseudo section and the depth of the mesh extends to the approximate depth of investigation. The approximate depth of investigation from the surface was 80 m from the electrodes at n = 6.

Data is displayed in section pdfs with the apparent and inverted data. The inverted sections are gridded at 12.5 m cell size to correspond with the horizontal distribution of the data. The plan maps were generated from the inverted data using the kriging method to generate a voxel in which depth slices were extracted.

5 RESULTS, INTERPRETATION, AND RECOMMENDATIONS

The final products of the survey include a series of inverted resistivity and chargeability plan maps at 40m depth from surface and cross-sections of the raw and inverted data. These deliverables, which are provided in digital format, allow for the interpretation of the subsurface geology and identification of potential mineralization targets.

The final products are attached to this report are the product deliverables outlined in Appendix A. Georeferenced inverted data has been included as Geosoft data base and CSV file for use with processing programs.

5.1 Geologic Background

At the Mt. Cameron Property and its extension, the Frenchvale Property, the primary exploration target is high-grade graphite mineralization. Previous studies conducted by Mt. Cameron Minerals Inc. further southwest have identified graphite-rich units within the marbles of the George River Group (Wightman, 2011). These investigations indicate that the mineralized marbles typically contain 4 to 6% graphite, with concentrations reaching up to 12% in certain areas.

5.2 Geophysical Results

The survey was designed to define the time-domain electromagnetic (TDEM) and magnetic responses within the George River Group carbonates, as identified by the Nova Scotia Department of Natural Resources and previous geophysical surveys. Resistivity values for the carbonates in the study area range from approximately 500 ohms to 4,000 ohms, surrounding one, possibly two, large conductive bodies with resistivity values below 1 ohm. A significant induced polarization (IP) response is observed along the edges of these conductive bodies, accompanied by a strong electromagnetic (EM) coupling signature, which appears to be concentrated in the center or between the two conductive bodies.

5.3 Geophysical Interpretation

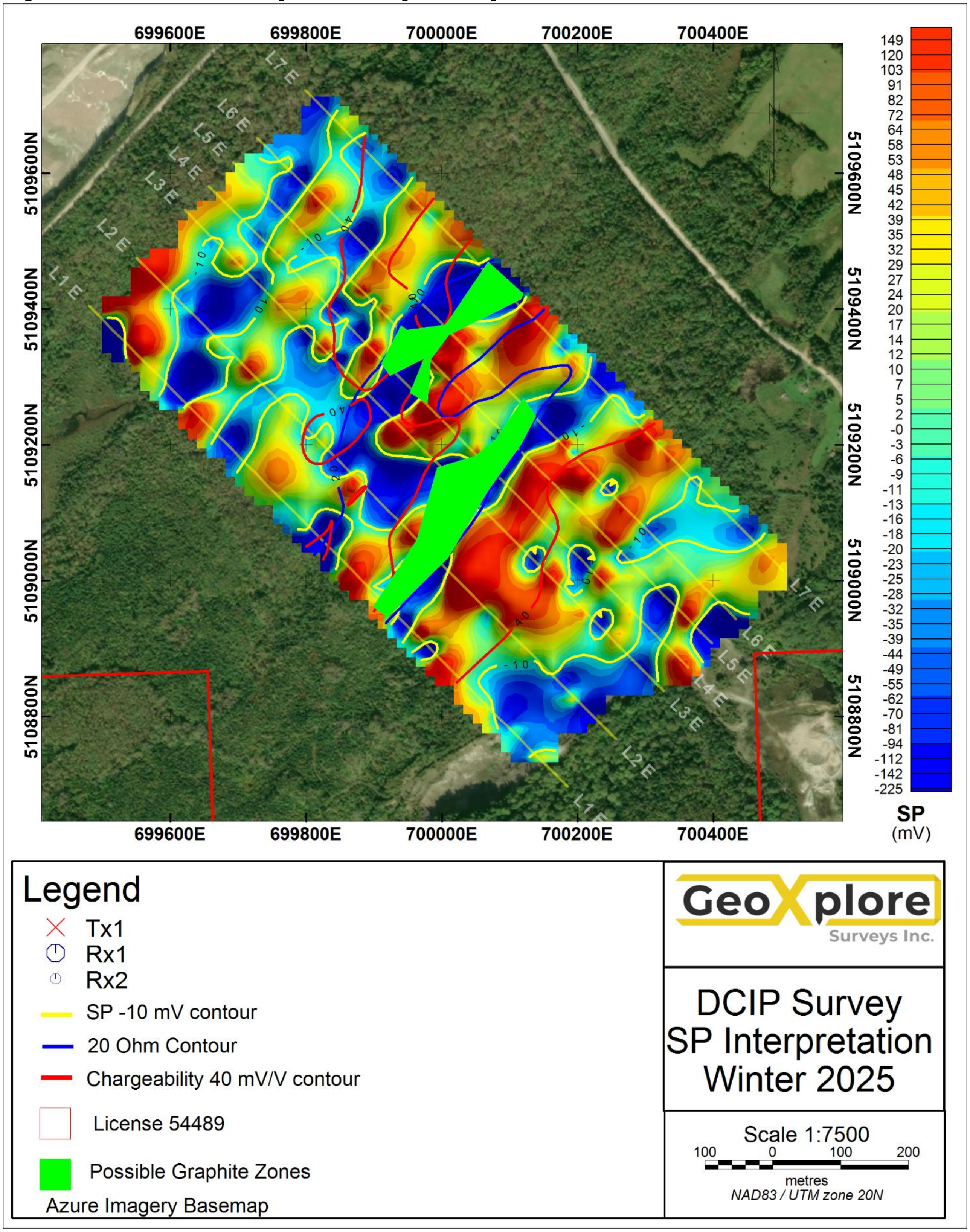
This section presents the results and discussion of the geophysical data collected, including resistivity and chargeability responses.

The study area has been identified as containing graphite mineralization, with reported concentrations ranging from 4% to 6%, and reaching up to 12% in some instances (Wightman, 2011). A recent study by Heritiana et al. (2019) demonstrated that self-potential (SP), chargeability, and resistivity responses can be correlated with areas where graphite content exceeds 5%. Applying this methodology to our survey data, we delineate zones where graphite content is likely to exceed 5%. However, caution is advised in interpreting these results, as steel electrodes were used for self-potential measurements instead of non-polarizing pot electrodes. It is important to note that steel electrodes can introduce polarization errors, which may lead to underestimation of SP values. This should be considered when correlating SP anomalies to graphite-rich zones.

In our analysis, we focus on inverted resistivity and chargeability data, identifying prospective areas where:

- Chargeability response exceeds 40 mV/V,
- Self-potential (SP) response is below -10 mV, and
- Resistivity values are below 20 ohms.

Figure 5: Self Potential Interpretation Map for Graphite



Here we discuss two different anomalies that warrant further investigation with drilling. One is the high chargeability values along the edges of the conductors and the other is the EM coupling between and in the most northern conductor.

IP responses on edges of the conductive anomalies indicating possible mineralized zone in altered rock if compared with the SP interpretation than these zones likely contain graphite along with a higher percentage of sulphide minerals Figures 6 and 7.

EM coupling refers to the interaction between the primary electromagnetic field generated by the survey equipment and secondary fields induced in subsurface conductive materials. This interaction can produce responses that complicate data interpretation. In geophysical surveys, EM coupling is often associated with highly conductive materials, such as interconnected networks of graphite or massive sulfide deposits. These materials can channel induced currents more effectively, leading to pronounced EM responses (Ward, 1988).

5.4 Recommendations

In this area, we recommend implementing the following steps to enhance the geologic investigation:

1. An exploratory drill hole through the anomaly at 700133E 5109173N with an azimuth of 317 degrees and a dip of -34 degrees is recommended to approximately 230m depth.
2. Further initial exploration drill holes would provide useful geologic information on Lines 4, 5, 6 in the anomalous regions identified in figure 5 provided in shapefile format.
3. Conduct infilling to achieve 50 m spaced lines using a Pole-Dipole survey with a spacings set at both 25 m and 50 m for an n of up to 15 to achieve a deeper depth of investigation. As well as extending the grid 200 m on both the Northeast and 100 Southwest portions of the grid to constrain and possibly close off the anomaly area.
4. Carry out a high-resolution ground magnetic survey with 15 m line spacing across the target, maintaining the same orientation as the DCIP lines. This is advised since discontinuities in the first vertical derivative of previous airborne surveys appear to correlate with IP anomalies.

Upon initiating drilling, the acquired drill data should be used to re-invert the DCIP data with stronger constraints, to achieve an increase in the reliability of the model.

Figure 6: Interpretation of anomalous zones. Resistivity section with Chargeability contour overlays.

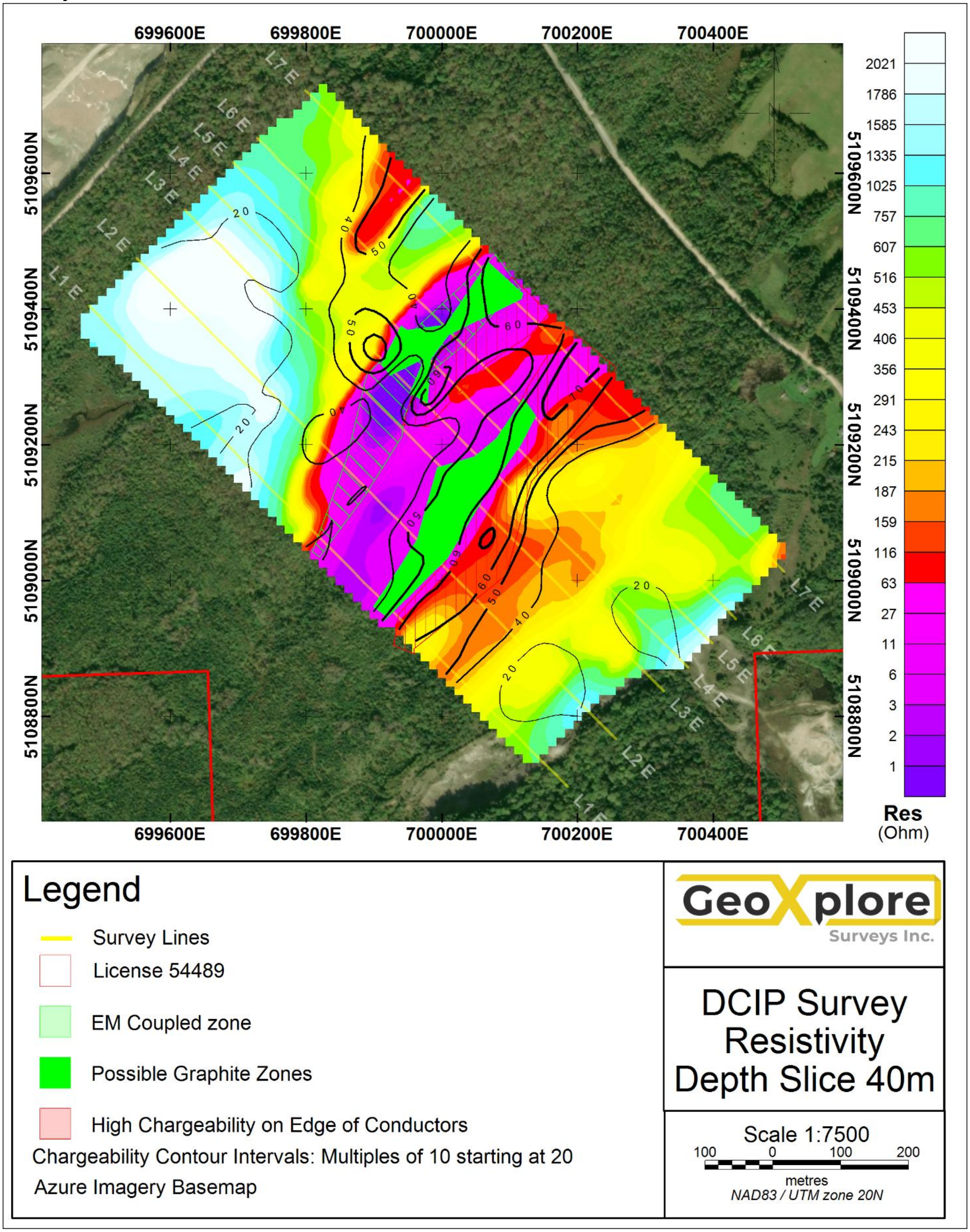
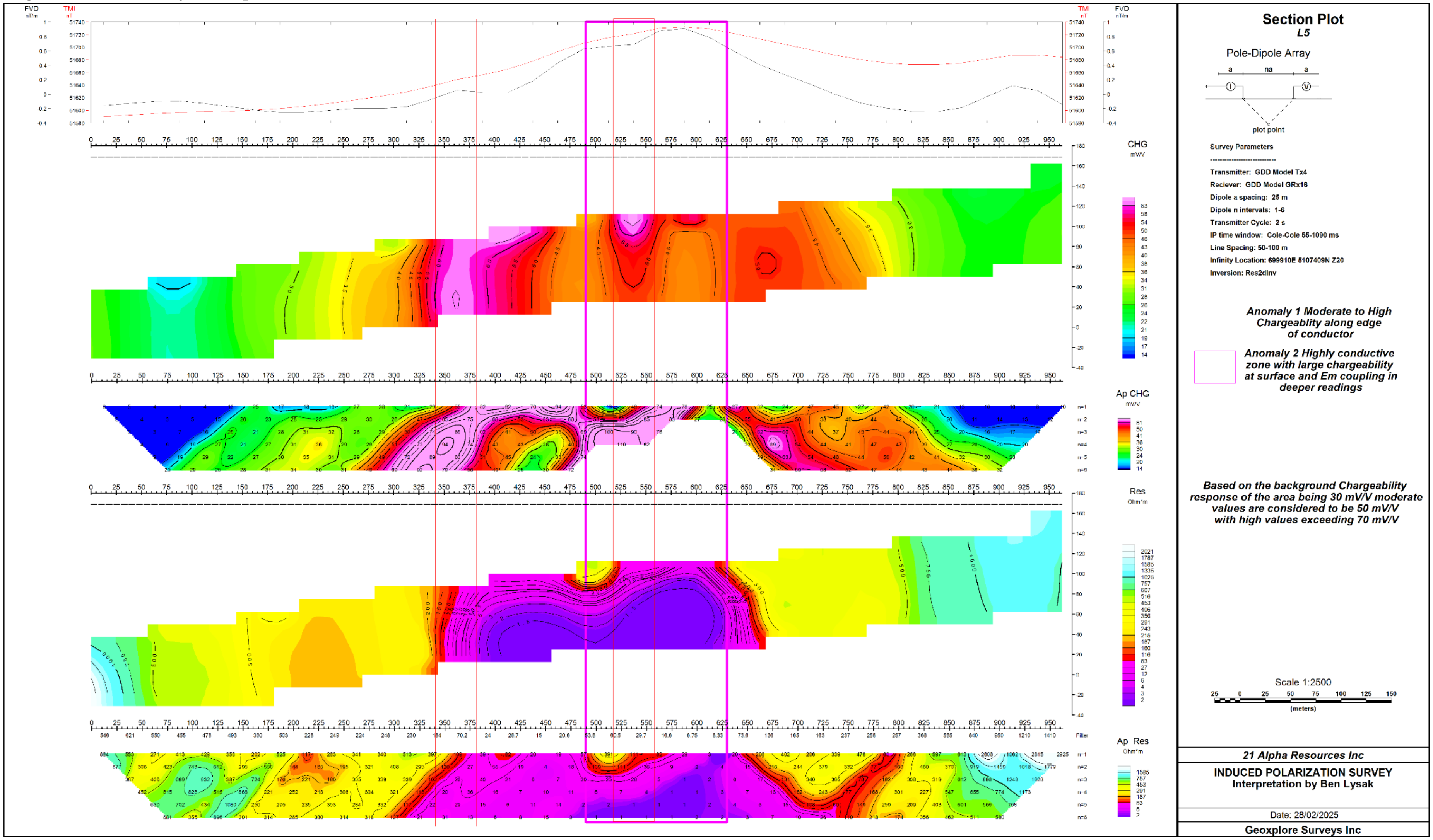


Figure 7: Anomaly interpretation on the Line 5 Section.



Statement of Qualifications

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I, Benjamin Lysak, MSc. P.Geo., do hereby certify that:

1. I am a consultant in geophysics, Geoxplore Surveys ltd.

2. I earned a Bachelor of Science Specialization in Geophysics in 2017 and a Master of Science Specialization in Geophysics In 2020.

3. I am a Geoscientist registered with the Association of Professional Geoscientists of Nova Scotia member 0348.

4. I have practised my profession for 7 years in exploration geophysics.

5. I have not received and do not expect to receive a direct or indirect interest in the properties covered by this report.

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Benjamin Lysak

References

Dubé, J. (2017). *Heliborne magnetic and TDEM survey, Mt. Cameron Project, Nova Scotia, 2017*. Dynamic Discovery Geoscience & Prospectair Geosurveys.

Loke, M. H., Tutorial: 2-D and 3D electrical imaging surveys, 1996-2004.

Telford, W. M. (1976). *Applied Geophysics*. Cambridge Univ. Pr.

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APPENDIX 1: DELIVERABLES

Table 3: Database channel and descriptions for GDB and XYZ.

Header	Description	Units/Format
X,Y,Z	XYZ of station location Georeferenced	Meters
T1X,T2X, R1X, R2X	Electrode locations in local coordinates	Meters
Tx1XYZ,Tx2XYZ, Rx1XYZ, Rx2XYZ	Georeferenced Electrode Locations	Meters
Stn	Reading Station Locations	Meters
Vp	Potential Difference	MilliVolts
I	Current	Amps
N	N station	
Date	Date	
Rescalc	Calculated Apparent Resistivity	Ohm*m
CHG	Calculated Apparent Chargeability	mV/V
IP[X]	IP decay measurement	mV/V

Table 4: Inverted Data channels and descriptions for GDB and XYZ.

Header	Description	Units/Format
X,Y,Z	XYZ of measurement location Georeferenced	Meters
Station	Reading Station Locations (Local)	Meters
Resistivity	Resistivity of modelled layer	Ohm*m
Conductivity	Conductivity of modelled layer	S/m
IP	IP response of modelled layer	
Line	Line Channel	

Table 5: Deliverable names and descriptions.

Grid Name	**Description**	**Grid Cell Size**	**Units**
L#_Frenchvale_sections	Raw and Inverted Sections	12.5 m	mV/V and Ohm*m
Frenchvale_PlanMap_CHG_Depth_###	Plan Map Showing lines and Chargeability	12.5 m	mV/V
Frenchvale _PlanMap _RES_ Depth_###	Plan Map Showing lines and Resistivity	12.5 m	Ohm*m
Frenchvale _DCIP _INV_2025	Inverted Data		
Frenchvale _DCIP _RAW_2025	Raw Data		

APPENDIX 2: INSTRUMENT SPECIFICATIONS

Single Transmitter	**5000W-2400V-20A**
Master-Slave configuration (2 Transmitters)	**10000W-4800V-20A**
Specifications (per Transmitter)	
Total weight (including accessories and shipping box)	58 kg
Weight (transmitter only)	40 kg
Total dimension (including accessories and shipping box)	34 x 52 x 76 cm
Operating temperature	-40° C to +65° C
	(-40° F to +150° F)
Electrical characteristics	
Time base	Time domain: ON+, OFF, ON-, OFF
	Time base: DC, 1, 2, 4, 8 et 16 seconds
Output current	0.030A to 20A (standard operation)
	0.0A to 20A (Open Loop protection disabled)
DC mode	Maximum of 5A
Output voltage	150V to 2400V / 14 voltage scales
Master-Slave configuration	Ability to link 2 GDD IP Transmitters of 3,600W or 5,000W to double power (7,200W or 10,000W) and the output voltage up to 4,800V
LCD display	- Output current 0.001A resolution
	- Output power
	- Ground resistance (when the transmitter is turned off, but plugged to the generator)
Power source	Standard 220-240V / 50-60Hz

Total weight (including shipping box and accessories)	23 kg
IP Receiver weight	7 kg
Total dimension	68 x 40 x 24 cm
Operating temperature	-40° C to +60° C
	(-40° F to +140° F)
Dipole number	Up to 16 dipoles simultaneously
Type of surveys	Surveys 1D, 2D and 3D
	Examples:
	4 lines X 8 channels
	2 lines X 16 channels
	1 line X 32 channels
Adjustment	Automatic synchronization, SP compensation, gain setting and stacking
ADCs	24-bit
Gain	From 1 to 1 000 000 000 (10^9)
Synchronization	Automatic and re-synchronization process on primary voltage signals
Twenty programmable chargeability windows	Arithmetic, logarithmic, semi-logarithmic, Cole and user defined
Noise reduction	Automatic stacking number

Main values read by the GDD IP Receiver	Apparent resistivity chargeability, standard deviation, % of symmetrical Vp, etc
Battery	Internal Lithium-Ion batteries and optional external Lithium-Ion battery pack
Enclosure	Heavy-duty Pelican case, environmentally sealed
Compatibility	Field device like Allegro[2] of Juniper Systems Inc.
Electrical characteristics	
Ground resistance	Up to 1.5 MΩ
Signal waveform	Time domain : ON+, OFF, ON-, OFF
	Time base : 0.5, 1, 2, 4, 8 et 16 sec
Input impedance	5 GΩ at 0.125 Hz and 130 MΩ at 7 Hz
Primary voltage	± 10μ to ± 15V for any channel
Protection	500V (on each channel)
Input	True differential for common mode rejection in dipole configuration
Voltage measurement	Resolution 1μV, Accuracy ≤ 0.15%

Chargeability measurement	Resolution 1µV/V, Accuracy ≤ 0.4%
SP offset adjustment	Automatic compensation through linear drift correction per steps of 150µ, with resolution of 1µV
Filter	Eight-pole Bessel low-pass 15Hz, notch filter 50 and 60Hz

APPENDIX 3: FINAL MAPS (ATTACHED IN ZIP FOLDERS)