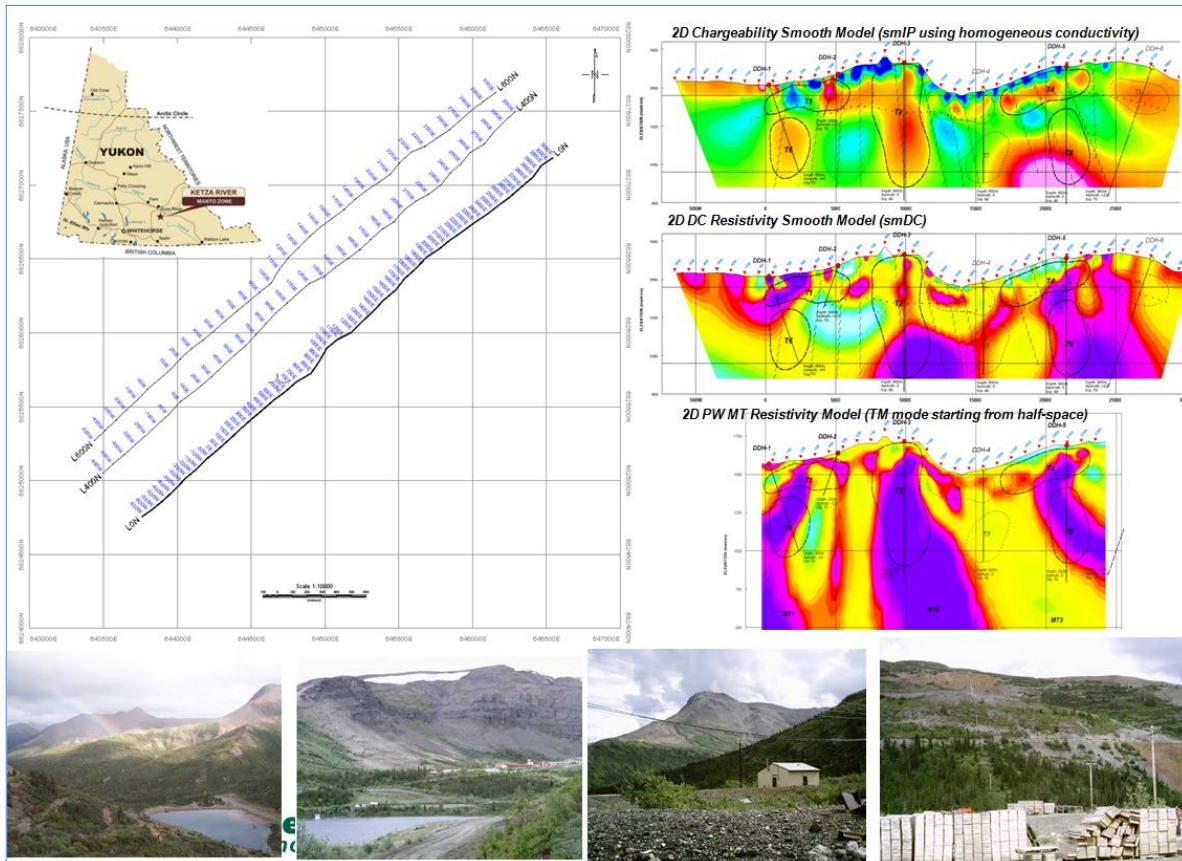


# Geophysical Survey Interpretation Report



**Regarding the Titan-24 Magnetotelluric  
Direct Current Resistivity and IP Survey  
over the KETZA RIVER PROJECT  
near Ross River, Yukon Territory  
for KETZA RIVER HOLDINGS LTD  
Vancouver, BC, Canada**

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K. Killin*

*November, 2009  
QGL Project: CA00681T*

## EXECUTIVE SUMMARY

At Ketz River Project, the Titan-24 survey has successfully identified at least eight geophysical anomalies (T1 to T8) in the DC/IP and MT raw data and inversion models with potential for polymetallic (Ag-Cu-Zn) manto type and gold mineralization from near surface to approximately 700 meters depth. Of all the interpreted DC/IP and MT zones, five anomalies (T1, T2, T4, T6 and T8) have been classified as high priority targets, and three zones (T3, T5 and T7) are classified as second priority targets.

The MT inversion models show good resolution of the anomalies to about 2000 meters depth. Three MT resistivity low anomalies (MT-1 to MT-3) have been delineated as significant targets for deep exploration in the property.

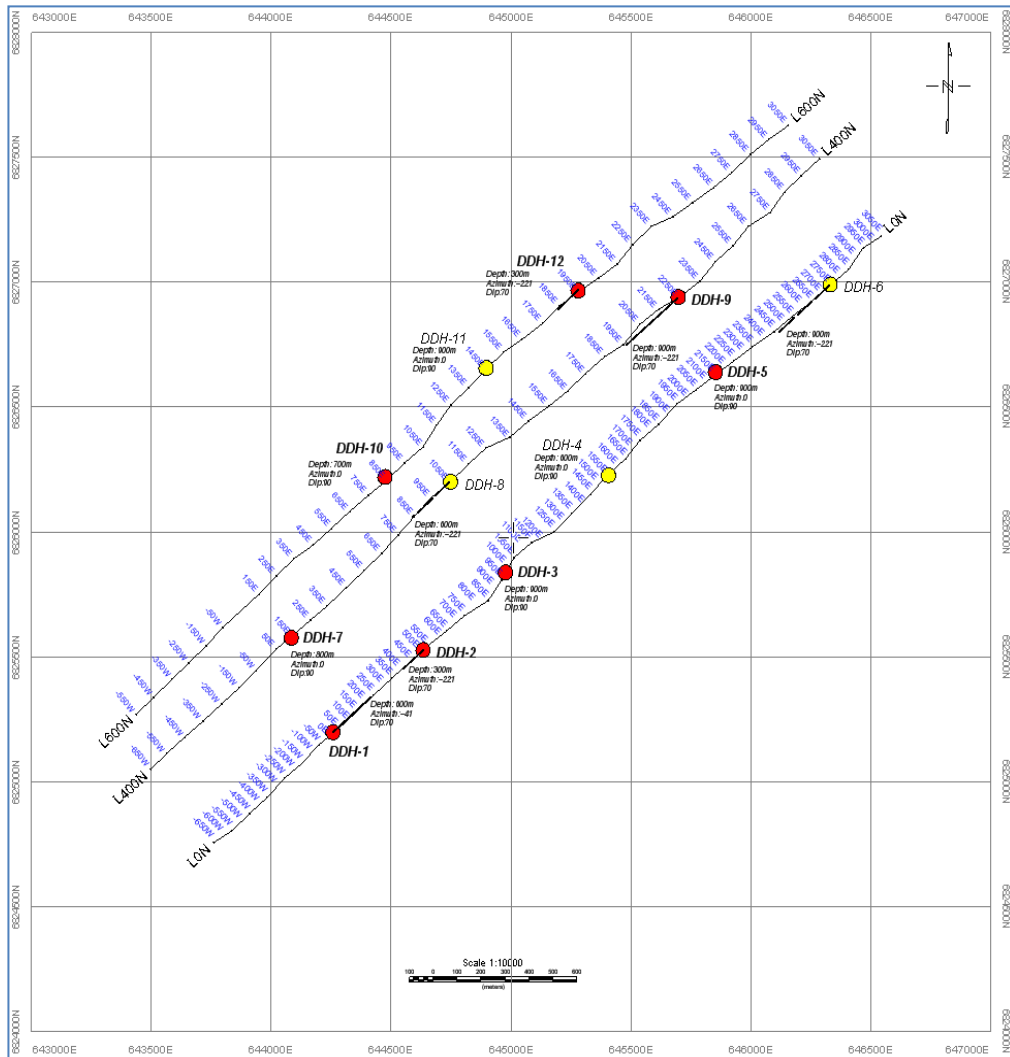
The interpreted deep MT resistivity low anomalies bellow and in the vicinity of the shallower Titan anomalous zones suggest the presence of significant mineralization and/or alteration zones within feeder channels at depths from 500 to >1200 meters. These deep MT responses are expected to be geologically and structurally controlled.

A second priority was assigned to the deep MT anomalies due to the depth of the targets, the limited coverage of the DC resistivity and IP chargeability at depth, and the inexistence of drillhole and/or geophysical data to corroborate the interpretation. In cases where the low MT resistivity responses are an extension of the shallower DC/IP chargeability, a higher priority may be assigned to these responses if significant results are intersected by the recommended drill holes.

The DC/IP & MT interpretation could possibly be affected by 3D and other linear structures (faults, veins, dykes, etc), which may run parallel and/or sub-parallel to the survey lines. The DC/IP and MT model interpretation and target prioritization was mainly based on the anomaly amplitude, extent and multi-parameter association.

The interpreted anomalies may not necessarily be directly related to gold and sulphide/oxide manto mineralization. Other sources, such as iron-rich formations, graphite and clay fault systems could produce similar DC/IP and MT responses.

A total of twelve (12) drillholes have been recommended to test the first and second priority targets interpreted in the property. The following table and figure summarize the location and parameters of the proposed drillholes for testing the interpreted anomalous zones.



***Plan Map with Location of the Drillhole Targets at Ketza River Project***

Hole ID	Priority	UTME	UTMN	Depth	Azimuth	Dip	Target	Line	Station
DDH-1	1st	644255.9	6825200.9	600	41	70	T1, T6	LON	25E
DDH-2	1st	644629.1	6825529.6	300	221	70	T1	LON	500E
DDH-3	1st	644972.6	6825843.5	900	0	90	T2	LON	975E
DDH-4*	2nd	645405.0	6826231.5	600	0	90	T3, T7	LON	1550E
DDH-5	1st	645852.2	6826646.1	900	0	90	T4, T8	LON	2150E
DDH-6*	2nd	646326.1	6826992.6	900	221	70	T5	LON	2750E
DDH-7	1st	644078.3	6825582.9	800	0	90	T1, T6	L400N	150E
DDH-8*	2nd	644744.6	6826207.8	600	221	70	T3, T2	L400N	1050E
DDH-9	1st	645695.3	6826948.2	900	221	70	T8, T4?	L400N	2250E
DDH-10	1st	644475.1	6826216.7	700	0	90	T2	L600N	850E
DDH-11*	2nd	644898.6	6826663.9	900	0	90	T3, T7	L600N	1450E
DDH-12	1st	645280.6	6826971.9	300	221	70	T4	L600N	1950E

***Recommended Drillhole Targets at Ketza River Project***

The following recommendations are derived from the interpretation of the DC/IP and MT survey at Ketz River Project:

1. Drill-test the top and center portions of the interpreted high priority anomalies, and if favorable drill results are obtained, then drill test the deep portion and unexplored areas in the vicinity of the chargeability anomalies where significant DC and MT resistivity responses are observed.
2. Review and evaluate all the available geophysical, geological and geochemical data in the vicinity of the priority target areas prior to drilling and commencing further exploration of these zones.
3. If mineralization is encountered during drilling the anomalies above the deep MT targets, consider extending the holes to test these responses.
4. When the deep targets are drilled, follow up with downhole BHTEM and consider physical property logging on all the targets in order to delineate the extent of the source and/or identify secondary sources of the anomalies.
5. Evaluate and re-interpret the existing conventional surface and borehole geophysical data to further enhance the interpretation and drill targeting.

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## 1. INTRODUCTION

Quantec Geoscience Ltd. conducted Titan-24 Direct Current Resistivity (DC), Induced Polarization (IP), and Magnetotelluric Resistivity (MT) surveys over the Ketz River Project for Ketz River Holdings Ltd. The survey data was acquired over a period of 13 days from August 9<sup>th</sup>, 2009 to August 21<sup>st</sup>, 2009.

The Ketz River property is located approximately 70 kilometers south of the Ross River in the Yukon Territories (Figure 1).

The survey at Ketz River Project consisted of three (3) Titan-24 DC/IP and MT single spreads (L0N, L400N and L600N) each covering 2.4 line kilometers over the project area. The line interval was 400 meters from line L0N to L400N and 200 meters from L400N to L600N. The grid azimuth was approximately 49 degrees true North with a local declination of 23 degrees East.



**Figure 1: Project General Location Map<sup>1</sup>**

### 1.1 SURVEY OBJECTIVES

The exploration objective of the Titan-24 survey at Ketz River Project was to map and locate DC/IP and MT anomalies potentially related to gold and polymetallic (Ag-Cu-Zn) manto type, gold mineralization and alteration zones to approximately 1500 meters depth.

In addition, the survey should assist in the following:

- Outlining anomalous zones to focus drilling and ground condemnation.
- Evaluating Titan-24 as an exploration tool for providing deep vectoring of the manto style occurrences within the Ketz region.
- Mapping the DC resistivity and IP chargeability of the sub-surface to assist geologic interpretation and mineral targeting within the top 500-750 meters.
- Mapping geological structures with MT resistivity contrasts and delineating deep conductors that may potentially represent alteration and/or mineralization to depths beyond 1.5 kilometers.

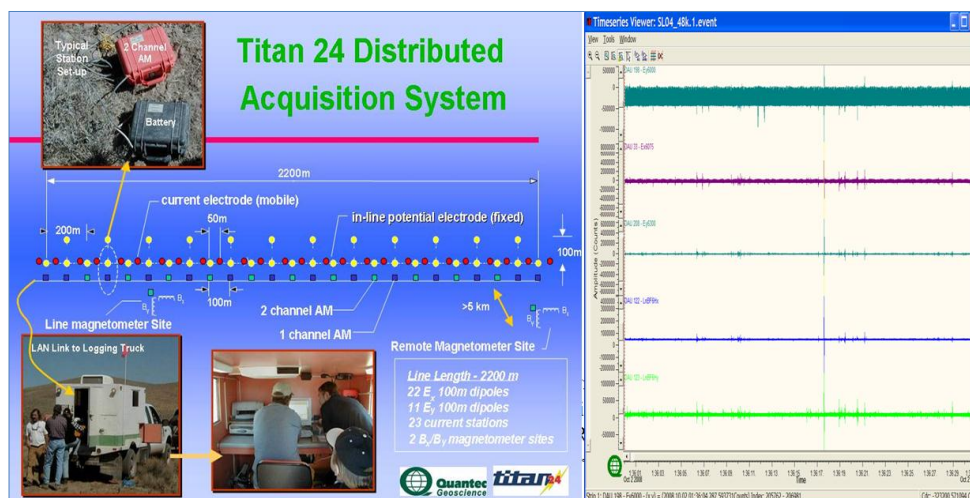
<sup>1</sup> General Grid Location Map supplied by Ketz River Holdings Ltd. August, 2009.

## 1.2 TITAN-24 DC/IP AND MT SURVEY OVERVIEW

The Titan-24 system combines Magnetotelluric Tensor (MT) Resistivity measurements capable of high resolution and deep penetration (>1.5 kilometers) with Galvanic Direct Current Resistivity and Induced Polarization (DC/IP) capable of shallow to mid-depth high resolution and penetration (~750 meters).

The system is designed to identify and discriminate between massive and disseminated mineralization and mapping geological contacts and deep conductors that may potentially represent alteration and/or mineralization at depth. Details on DC Resistivity, Induced Polarization and Magnetotelluric theory are available in Appendices C and D.

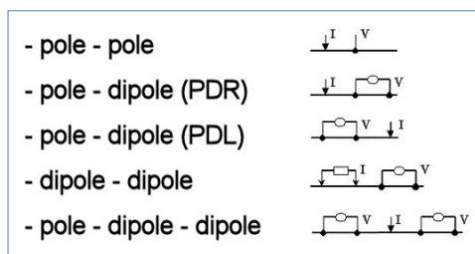
Titan-24 is a multi-channel Distributed Acquisition System (DAS), (Sheard, N., 1998), which records full-waveform time series for each geophysical event (Direct Current Resistivity, Induced Polarization and Magnetotelluric), enabling the application of sophisticated digital signal processing techniques to ensure the best possible data quality (Figure 2).



**Figure 2: Titan-24 DC/IP and MT Survey Layout and Example of the Acquired Timeseries**

For each line surveyed, the DC/IP utilized a dipole-pole-dipole configuration with 100 meters dipoles (Figure 3). The current injection points were located at every 50 meters between the potential dipoles along the lines. The cross-line dipoles<sup>2</sup> were located every 200 meters with a 100 meters separation between the electrodes. The DC/IP survey also had current extensions at every 100 meters for an interval of 600 meters at the ends of the spreads for all three lines in the survey.

The DC and IP data were acquired from station 650W to station 350E, covering a total of 3.7 line kilometers (including the current extensions) for each line surveyed.



**Figure 3: Common DC/IP Survey Layouts**

<sup>2</sup> Note: For the DCIP component the cross-Line  $E_y$  voltages are obtained for future reference purposes and are not presented in cross-sectional plots.

The MT data were acquired over the frequency bandwidth of 0.01 Hertz to 10000 Hertz. The Titan24 MT configuration used contiguous 100 meter dipoles for measuring the in-line electric field ( $E_x$ ) and 100 meter dipoles at every second site (every 200 meters) for measuring the orthogonal (cross-line) component ( $E_y$ ).

Two pairs of orthogonal magnetometers, one pair for the high frequency data and one pair for the low frequency data were used to record the  $H_x$  and  $H_y$  magnetic field.

A remote reference site, located approximately 5-10 kilometers from the survey area, was used for noise reduction, quality control and monitoring. The remote reference station consisted of one pair of orthogonal dipoles for measuring the electric field ( $E_x$  and  $E_y$ ) and two pairs of orthogonal magnetometers orientated in the same direction as the survey lines to record the  $H_x$  and  $H_y$  magnetic field.

The MT data were acquired from station 0E to station 2400E, covering a total of 2.4 line kilometers for each line surveyed.

Appendices C, D, and I, as well as the "Geophysical Survey Logistics Report" submitted previously, provide more information on the survey configuration and parameters (E. Data et al. August, 2009).

The DC/IP and MT data were further processed, inverted and interpreted using a threefold multi-parameter sectional view of the results, as presented later in the report. For each line surveyed, three independent 2D earth models (IP Chargeability, DC and MT PW Resistivity) are calculated and presented for interpretation and targeting.

Additional inversion models (for both the DC/IP and MT data) are available for review in Appendix E, and on the digital archive supplied along with this interpretation report.

## 2. SURVEY DESCRIPTION

### 2.1 GENERAL SURVEY DETAILS

- **Quantec Project Number:** CA00681T
- **Client:** Ketza River Holdings Ltd
- **Client Address:** 540 – 688 West Hastings Street  
Vancouver, BC  
Canada  
V6B 1P1
- **Survey Period:** 13 days from August 9<sup>th</sup> to August 21<sup>st</sup>, 2009
- **General Location:** Approx. 70km south of Ross River
- **District/Province:** Yukon Territory
- **Nearest Settlements:** Ross River, Yukon
- **Coordinate System:** Universal Transverse Mercator
- **Datum & Projection:** NAD 27, Zone 08V
- **Latitude/Longitude:** ~ 61°32'05.99N, 132°17'13.39W
- **Grid Reference Position:** ~ 644234E, 6825180N<sup>3</sup>

### 2.2 ACCESS

- **Base of Operations:** Ketza River Holdings Ltd Camp, Yukon Territory
- **Mode of Access to Grid:** Trucks and ATVs
- **Mode of Access to Lines:** Trucks, ATV and by foot

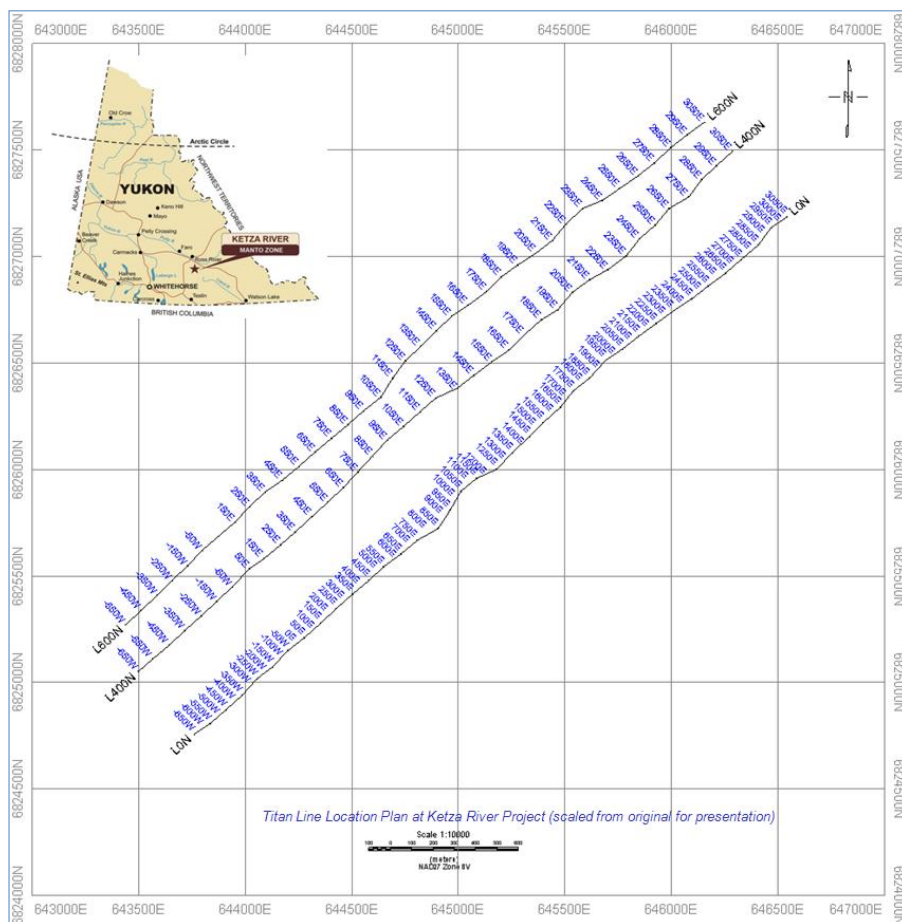
### 2.3 SURVEY GRID

- **Established by:** Ketza River Holdings Ltd
- **Lines Azimuth:** ~ 49° True
- **Declination:** ~23° East
- **Station Interval:** ~100 meters
- **Line Interval:** ~200 & 400 meters
- **Coordinate Reference System:** Survey Grid referenced to UTM (NAD 27, Zone 08V)
- **Method of Chaining:** Metric, slope distance, pickets GPS surveyed

### 2.4 SURVEY WORK UNDERTAKEN

- **Number of Lines Surveyed:** 3 lines (Figure 4)
- **Survey Coverage:** DC/IP survey: 7.2 km  
(11.1 km with current extensions)  
MT survey: 7.2 kilometers

<sup>3</sup> GPS Reference Coordinates supplied by Ketza River Holdings Ltd. August, 2009.



**Figure 4: Titan-24 Line Location Map**

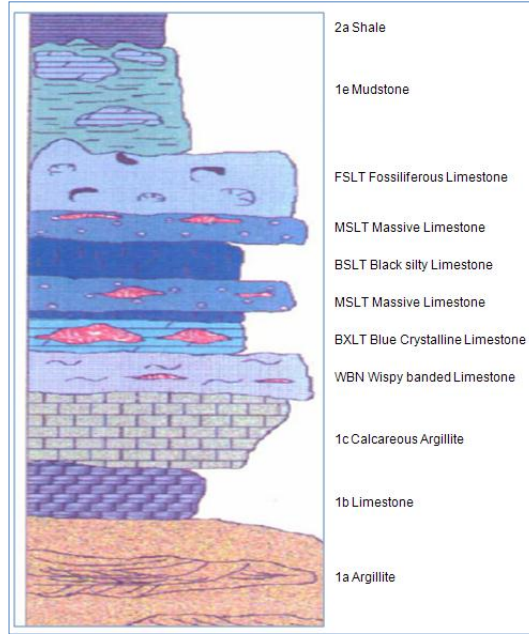
## 2.5 REGIONAL GEOLOGY

The Property is located in the Pelly Mountains of central Yukon. The mountains are made up of a shallow marine miogeoclinal sequence of rocks forming a carbonate platform bounded by the Omenica Tectonic Belt to the southwest and a faulted lobe of the Yukon Tanana Terrain to the northeast across the Tintina Fault. This carbonate platform is known as the Cassiar Terrain or Pelly-Cassiar Platform (Pelly-Cassiar), Russ, W. & Leah, M. (2008).

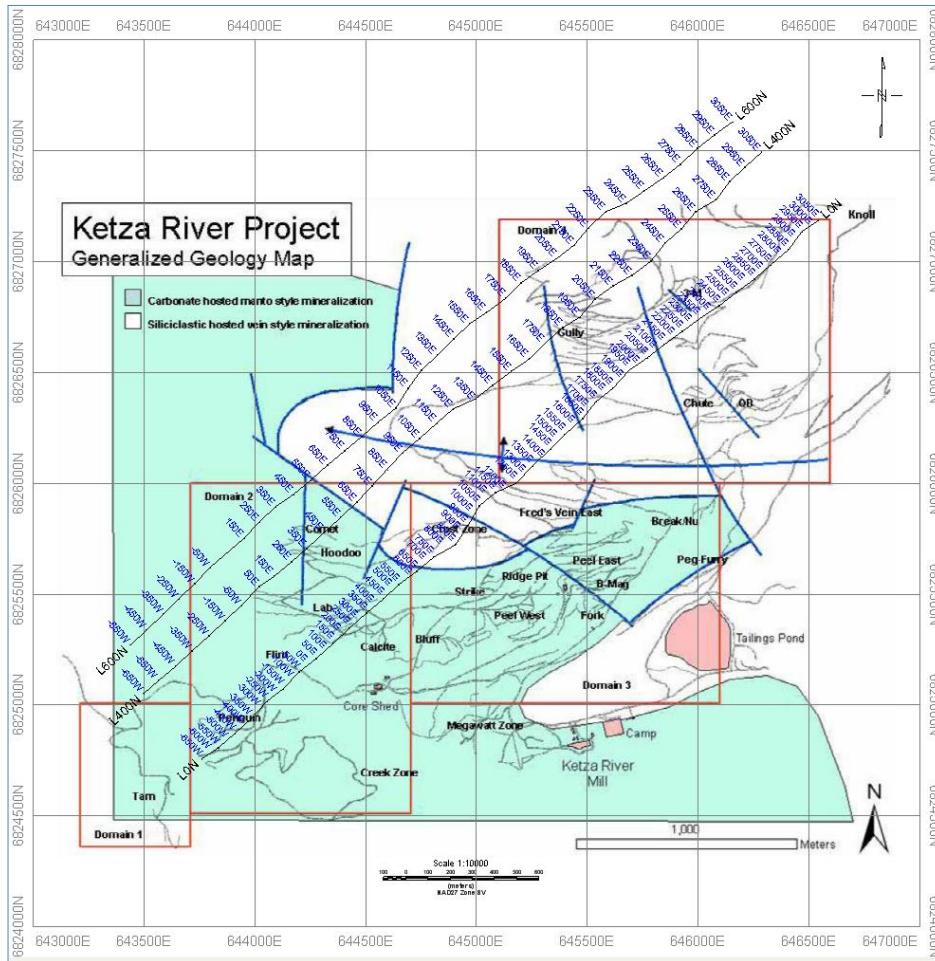
## 2.6 KETZA RIVER PROPERTY GEOLOGY<sup>4</sup>

The Property is underlain by Lower Cambrian carbonate and clastic sedimentary rock units. The Lower Cambrian units (1a, 1b, 1c, 1d, and 1e) form a conformable series (Figure 5), which is unconformably overlain by Late Cambrian black shale (2a), Fonseca (1998). The general surface geology is outlined in Figure 6.

<sup>4</sup>The information presented in this section was captured and edited from the National Instrument NI 43-101 Technical Report. Yukon-Nevada Gold Corp. Ketza River Project. Yukon Territory, Canada". Prepared for: Yukon-Nevada Gold Corp. 1600 Stout Street, Ste. 1317, Denver, CO 80202. SRK Project Number: 174703. Prepared by SRK Consulting Engineers and Scientists. 7175 W. Jefferson Ave. Suite 3000. Lakewood, CO 80235..



**Figure 5: Stratigraphic Column**



**Figure 6: Generalized Geology Map with Titan Lines overlay**

### 2.6.1 Local Lithology

- Unit 1a is composed of interbedded argillite, phyllite, siltstone, sandstone, quartzite, limestone and calcareous units. The unit outcrops in the center of the Ketz Uplift north of the Peel fault that encompasses the Shamrock target zone.
- Unit 1b is a narrow bed of silty limestone. The unit is not found at the surface on the property but has been intersected in drillholes.
- Unit 1c is composed of phyllitic limestone, calcareous mudstone and argillaceous limestone. This unit crops out in exposures along Cache Creek above the mill site.
- Unit 1d is host to all replacement-type manto mineralization on the property. The unit is composed of bedded limestone and it is locally dolomitized, recrystallized and weathered near the mineralization.
- Unit 1e is composed of green mudstone bed. The unit is locally clay or talc altered in the vicinity of mineralization. The mudstone is generally poorly exposed and forms the hanging wall of the Peel zone.
- Unit 2a is composed of carbonaceous to graphitic black shale. The unit crops out in the fault-bounded panels at the Peel Oxide zone and in the Sue Creek area north of Cache Creek.

### 2.6.2 Alteration

Dolomitization or iron carbonate replacement alteration envelopes the manto mineralization and is especially well developed in areas lateral to the mantos where the host limestones are brecciated. Silicification, sulfidization, and bleaching are closely associated with quartz-sulfide veins in sedimentary rocks in the argillite-hosted targets.

### 2.6.3 Structure

The Property lies on the southern flank of a westward plunging anticline which is cored by the Unit 1a argillite exposed along Peel Creek. Limestone beds of Unit 1d host gold-bearing oxides and sulfides at the Hoodoo and Comet zones in the core and on the western limb of a tight anticline.

A synclinal closure has been mapped in the Peel Ridge mine site area where mineralized bodies occur on both limbs of the fold. The Peel fault intersects the Ridge zone ore deposit and juxtaposes Lower Cambrian argillite Unit 1a over the Lower Cambrian limestone Unit 1d. The fault has two different orientations, steeply dipping east of the Ridge zone and shallow dipping over the Ridge zone and to the west. The fault has been traced westward to the area of the Lab deposit.

The Ketz Uplift is composed of uplifted and altered Lower Cambrian Unit 1a strata. Structures within the uplift include thrust faults, upright folds, and high-angle normal faults all of which have strong spatial association with plutonic related type deposits.

## 2.7 DEPOSIT TYPES<sup>5</sup>

The deposits on the property are generally of two types:

- a- Manto-type and chimney carbonate-hosted replacement sulfide/oxide deposits.

The mantos and chimneys are preferentially hosted by the limestone facies which are confined to the south side of the Peel fault. The location of mineralization is controlled by normal faults, fold hinges and by the location of the carbonate facies. The mantos are elongated, sub-horizontal gold-rich polymetallic massive sulfide bodies with significant lead and zinc content (Nelson, 2005,

<sup>5</sup> The information presented in this section was captured and edited from the National Instrument NI 43-101 Technical Report. Yukon-Nevada Gold Corp. Ketz River Project. Yukon Territory, Canada". Prepared for: Yukon-Nevada Gold Corp. 1600 Stout Street, Ste. 1317, Denver, CO 80202. SRK Project Number: 174703. Prepared by SRK Consulting Engineers and Scientists. 7175 W. Jefferson Ave. Suite 3000. Lakewood, CO 80235.

in Russ, W. & Leah, M., 2008). The manto type mineralization occurs along permissive horizons within limestone. The chimneys are sub-vertical, structurally controlled massive sulfide bodies within the Lower Cambrian limestones.

Massive deposits of iron sulfides consist primarily of pyrrhotite with the remaining sulfides consisting of arsenopyrite, pyrite, marcasite and chalcopyrite. Galena and sphalerite are rare. Oxidized mineralogy primarily consists of hematite and goethite.

- b- Quartz-sulfide fissure veins and quartz-breccia zones (stockwork systems) in siliciclastic rocks that occur north of the Peel fault.

The quartz-sulfide fissure vein and quartz-breccia systems occur in a sequence of interbedded Lower Cambrian phyllite, argillite, siltite, quartzite and carbonate rocks on the eastern side of the Ketza Uplift.

Mineralization consists of pyrrhotite, pyrite and arsenopyrite in massive quartz-sulfide fissure veins and quartz-breccia veins with lesser stockwork and dissemination. These veins are controlled by moderate to high-angle faults. Both styles of mineralization are locally oxidized.

## 2.8 MINERALIZATION ZONES RELEVANT TO THE TITAN SURVEY AREA<sup>6</sup>

The most significant mineralization zones documented on the property are represented in the following map (Figure 7) and briefly described in the following sub-sections.

The sulfide mantos relevant to the Titan survey area include the Penguin, Lab and Flint zones. The Penguin and Lab areas are gold-rich carbonate-hosted chimney and manto-style sulfide mineralization and its oxidized equivalent. Oxide mantos include the Ridge and Hoodoo zones. The Fred's Vein East, the Gully and 3M are classified as fissure veins, breccia zones and disseminations rather than chimneys and replacement mantos.

- Penguin Zone

The Penguin zone is manto-style sulfide mineralization located in the Cache Creek drainage. Two mineralized bodies occur within a presently defined Penguin area. The first zone, formerly known as the Flint zone, is sub-vertical with a plunge to the southwest. The second zone is more flat-lying with a plunge southwest.

- Lab Zone

The Lab zone is manto-style sulfide mineralization located on the southern slope of Peel Ridge. The Lab zone consists of four distinct zones.

- Hoodoo Zone

The Hoodoo zone is manto-style oxide/sulfide mineralization located on the southern slope of Peel Ridge. Geometrically the Hoodoo zone is a flattened cylinder. The sulphide mineralization is underlying the oxide mineralization exposed at surface.

- Ridge Oxide Zone

The Ridge oxide manto zone consists of three nearly flat-lying separate mineralized bodies. Oxide mineralization is cut off by northwest-trending East Side fault.

- Fred's Vein East

Fred's Vein East is a quartz-sulfide vein-like occurrence in siliciclastic rocks on the north side of the Peel fault. The vein is located on the north side of Peel Ridge in the Peel Creek drainage.

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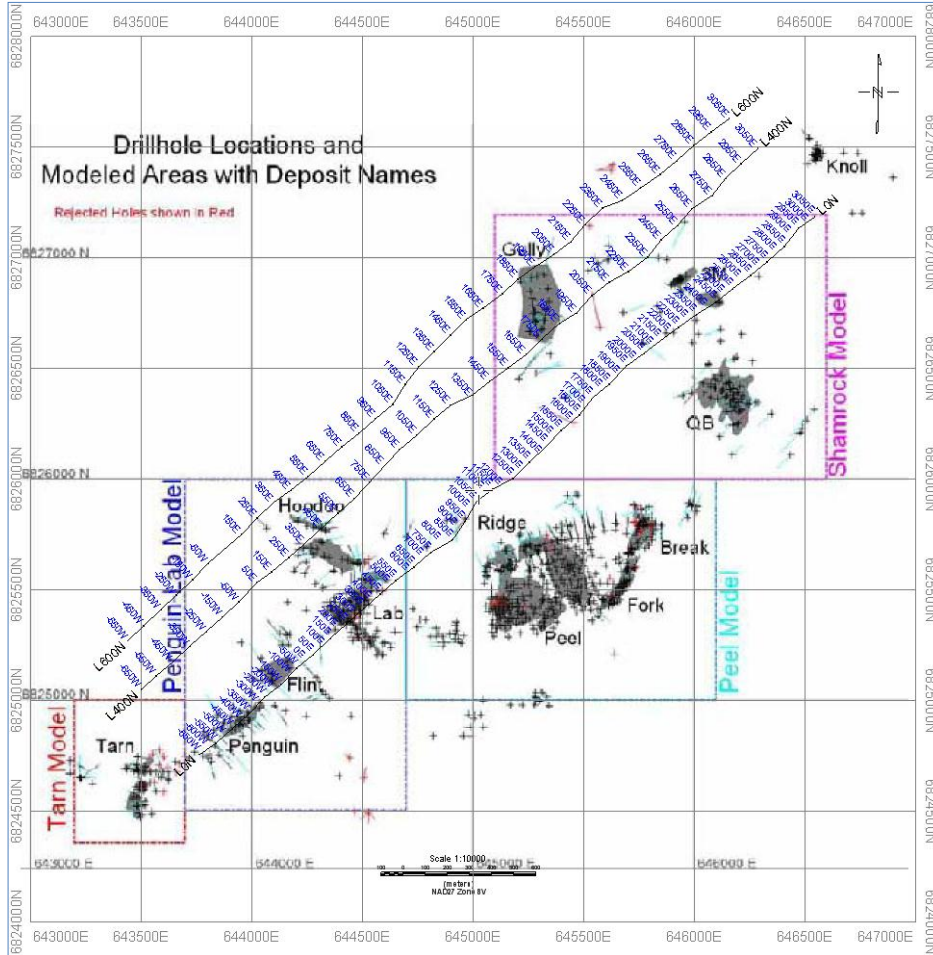
<sup>6</sup>The information presented in this section was captured and edited from the National Instrument NI 43-101 Technical Report. Yukon-Nevada Gold Corp. Ketza River Project. Yukon Territory, Canada". Prepared for: Yukon-Nevada Gold Corp. 1600 Stout Street, Ste. 1317, Denver, CO 80202. SRK Project Number: 174703. Prepared by SRK Consulting Engineers and Scientists. 7175 W. Jefferson Ave. Suite 3000. Lakewood, CO 80235.

- Gully Zone

The Gully zone is a quartz-sulfide vein occurring in siliciclastic rocks north of the Peel fault. The vein is located on the south flank of Shamrock Mountain in the Peel Creek drainage.

- 3M Zone

The 3M zone consists of quartz breccia and disseminations in siliciclastic rocks. The zone is located on the ridge between Peel and Misery Creeks.



**Figure 7: Historic Drillhole Location Plan Map**

## 2.9 PREVIOUS EXPLORATION

The full extent of exploration on the property is not known to the author at the time of writing this report. According to the National Instrument NI-43-101 the historic work in the property included:

- Geophysical surveys including ground magnetic, gravity, airborne EM-Magnetic, HLEM and VLF.
- Multi-element soil geochemistry.
- Petrographic study for manto-style mineralization.
- Rock Sampling.
- Geological mapping.
- Diamond drilling and trenching.
- Low-altitude aerial photography.
- Underground exploration.

No information and/or maps from historic surveys were supplied by Ketz River Holdings Ltd. Although the National Instrument indicates that the property has been extensively explored for manto-style sulfide/oxide and for quartz-sulfide veins & quartz-breccia stockwork mineralization (Figure 7).

The available maps from historic surveys will be used for referencing and corroborating the Titan targeting only. No interpretation of the data is included in this report.

Additional information from previous exploration is compiled in the Technical Report "NI 43-101. Yukon-Nevada Gold Corp. Ketz River Project", available in the Yukon Nevada Gold Corp Web site at: <http://www.yukon-nevadagold.com/s/KetzManto.asp?ReportID=296836>

### 3. RESULTS

This section presents the results of the Titan-24 data inversions and interpretation in context with the survey objectives and significance to future exploration at Ketza River Project. Appendix E provides pseudo-section plots of the DC/IP and MT data used in the 2D inversions along with a more complete description of the data processing and inversion parameters.

In *Section 3.3* the 2D inversion models are presented graphically in Geosoft plot format along with an interpretation overlay and comments on the most significant results and recommended targets. Scaled maps and sections of the DC Resistivity, IP Chargeability and MT Resistivity models are also provided in Appendices F, G and H.

#### 3.1 2D DC RESISTIVITY & INDUCED POLARIZATION INVERSIONS

In general, the quality of the DC/IP raw data is good. Pre-processing of the DC Resistivity & Induced Polarization (DC/IP) data involved adjustment of data errors and removal of poor quality data. For the DC/IP inversions, the UBC (DCInv2D<sup>TM</sup> and IPIInv2D<sup>TM</sup>) 2D platform was used (Oldenburg & Li, 1994).

Several 2D DC and 2D IP inversion models were calculated in order to produce a sound geological representation of the acquired data. Smooth inversion models “smDC and smIP” were produced for both, the DC resistivity and IP datasets. No sharp inversions were run for the DC and IP data.

The inversions were generally run with successive removal of poorly fitting data and error adjustment before arriving at the final 2D models. Some data acquired with large transmit-receiver separations were not of high quality and were removed prior to inversion.

In some instances, when using the DC inversion models as the reference for the chargeability calculations, the inversions produced models with abnormally large chargeability amplitudes and anomaly extents that are not consistent with the raw data.

In order to reduce the uncertainty of the inversion models, additional IP inversions (nullcon) were derived by inverting the IP data assuming a constant resistivity distribution (half-space or homogeneous conductivity). These models are thought to have provided a relatively better image of the apparent chargeability distribution in the sections in the presence of conductive units contrasting with highly resistive rocks. The “smDC and smIP nullcon” inversion models were found to produce consistent results and were used for presenting the geophysical interpretation.

A more detailed discussion of the UBC inversion technique, acquired DC/IP data and inversion results can be found in Appendix D.

#### 3.2 TENSOR MAGNETOTELLURIC INVERSIONS

In general, the MT raw data quality is good. No significant sources of cultural or telluric noise have been documented in the vicinity of the survey area. The MT signal was relatively low for the dead band between 1 to 3 kHz. The low frequency data were generally good.

The unconstrained Tensor Magnetotelluric (2D MT) inversion models were calculated using the Geotools<sup>TM</sup> MT data processing and model-inversion platform. The initial data input into the Geotools database were line-station unrotated data, taken directly from the EDI archive<sup>7</sup>.

One-dimensional (1D) inversion models for each mode<sup>8</sup> (XY and YX) of the unrotated data were generated at each site. The apparent resistivity and phase from the 1D model were interpolated to obtain twelve (12) frequency responses per decade. The resistivity and phase curves were auto-fitted to the data points. The TE mode was set to YX and interpolated. Stitched 1D TE & TM and the Determinant sections (det) were also created for interpretation purposes, data quality control, and to produce starting models for the PW inversions.

<sup>7</sup> Electronic Data Interchange (EDI) data available in the digital archive submitted with the “Geophysical Survey Logistics Report.

<sup>8</sup> MT Modes include: Transverse Electric field (TE or XY) parallel to geology (strike direction) and Transverse Magnetic field (TM or YX) perpendicular to geological strike (dip direction).

Alternative 2D smooth models were constructed using the RLM inversions (Rodi & Mackie, 2001). The RLM inversion models were calculated using the interpolated resistivity and phase curves in the 10 KHz to 0.01Hz bandwidth, assuming a 5% error for the resistivity and 3 degrees error for the phase, at 4 to 6 equi-spaced frequencies per decade.

One RLM “mus\_hrp” inversion model was derived from inverting the unrotated data using a half space resistivity (homogeneous resistivity model) of ~2500 Ohm-meters as starting model. The model uses the TM (phase and resistivity) and TE (phase and resistivity) data modes for the model calculation.

Similarly, four (4) sets of 2D PW MT Resistivity models were derived from inverting the Magnetotelluric data using different starting models and data modes.

The “pum\_hrp” was derived from inverting the unrotated data using a half space resistivity (homogeneous resistivity model) of ~2500 Ohm-meters as starting model. The model uses the TM (phase and resistivity) and TE (phase and resistivity) data modes for the model calculation.

The “pum\_drp” was derived from inverting the unrotated data using the Stitched 1D Determinant resistivity model (det) as starting model. The model uses the TM (phase and resistivity) and TE (phase and resistivity) data modes for the model calculation.

The “pum\_h-p” was derived from inverting the unrotated data using a half space resistivity (homogeneous resistivity model) of ~2500 Ohm-meters as starting model. The model uses the TM (phase and resistivity) and TE (phase) data modes for the model calculation.

The “pum\_htm” was derived from inverting the unrotated data using a half space resistivity (homogeneous resistivity model) of ~2500 Ohm-meters as starting model. The model uses the TM (phase and resistivity) data mode for the model calculation.

Details on the MT inversion parameters and alternate inversion models are also available in Appendix E and Appendix F.

### 3.3 TITAN-24 MULTI-PARAMETER INTERPRETATION

This section<sup>9</sup> presents the results of the most significant geophysical anomalies and potential targets interpreted from the final DC/IP and MT inversion models. A brief description of the results and targeting recommendations are also provided in this section. Only the “smDC”, “smIP nullcon” and “pum\_htm” models are used for presenting the interpretation results. These inversion models were found to produce consistent results when correlating with the known geology and mineral occurrences in the property. Additional maps and sections are also available for further interpretation and review in Appendix F and Appendix G.

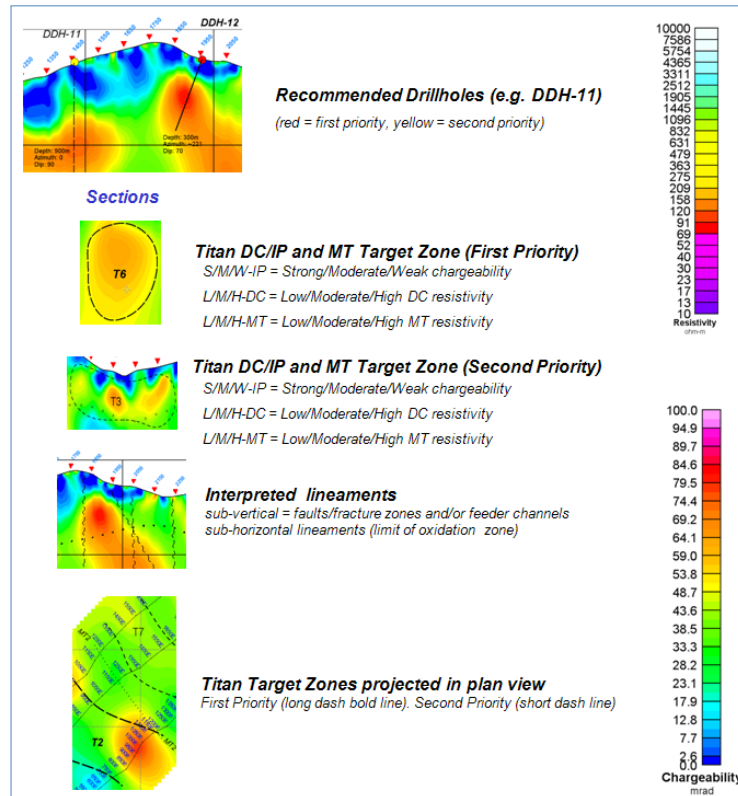
The geophysical interpretation is presented graphically in figures containing 2D sections of the PW MT Resistivity, DC Resistivity and IP Nullcon Chargeability models with an overlay of the final target areas and anomaly trends.

The target zones enclosed by the polylines as drawn in the sections and plans represent the best possible line-to-line correlation of the DC, IP and MT anomalies derived from all the available inversion models. The interpretation was also based on the relative position and depth of the anomalies on the sections and plans. The general geology and structural interpretation from historic surveys compiled in the National Instrument (Section 2.9) was also used for the interpretation.

For the DC and MT resistivity gridded data (sections and maps), cool colors (blue series) represent resistivity highs and warm colors (red series) resistivity lows. Alternatively for the IP, cool colors represent chargeability lows, and warm colors represent chargeability highs. Unless specified otherwise, all resistivity plots are in the 10-10000 Ohm-meters range and the chargeability plots in the 0-100 milliradians, Figure 8.

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<sup>9</sup> The final inversion models only are shown in this section. It is useful to review the actual raw data input into the 2D and 3D inversions (Appendix E), which is available in the Logistics Report previously submitted.



**Figure 8: Legend for the Titan Multiparameter Interpretation**

### 3.3.1 Titan Target Classification

The Titan-24 anomalous zones were classified and assigned a target priority according to amplitude, size and multi-parameter IP, DC and MT Resistivity association as follow:

- **First priority targets:**
  - Large to moderate area (>300x300m) anomalies exhibiting strong IP response (>70 milliradians), with DC and MT resistivity low association ( $\rho < 100$  ohm-meters); interpreted to be consistent with massive to semi-massive gold and sulphide/oxide mineralization (Manto type).
  - Strong DC Resistivity low anomalies (<100 Ohm-meters) with no significant IP responses; interpreted to be high conductive/non-chargeable massive mineralization (e.g. possible gold), and also no-mineralized structures.
- **Second priority targets:**
  - Large to moderate area (>300x300m) anomalies exhibiting moderate IP response (30-70 milliradians), located at the edges and/or over DC and MT resistivity moderate to low gradient zones ( $\rho < 1000$  ohm-meters); interpreted to be consistent with semi massive to weak mineralization.
  - Moderate area (~300x300m) anomalies exhibiting strong to moderate IP response (30-70 milliradians), located either over DC and MT resistivity high or over gradient zones ( $\rho > 1000$  ohm-meters); interpreted to be consistent with disseminated mineralization and/or alteration.
  - Deep MT resistivity lows and gradient zones ( $\rho < 100$  ohm-meters at >500 meters depth); consistent with deep mineralization, alteration, structures and/or feeder zones.

### 3.4 DC/IP AND MT TARGETS FROM 0 TO 700 METERS DEPTH

The DC/IP and MT anomaly interpretation presented in this section is oriented to target polymetallic (Ag-Cu-Zn) manto type and gold mineralization; however the interpretation results do not necessarily represent mineralization, mineral grade and or the full extent of the sources of the anomaly and are not intended for metal differentiation. Different geological, structural and mineral assemblages may produce similar anomalies in terms of response amplitude, shape, orientation and size.

The DC/IP and MT responses may be caused not only by gold and Ag-Cu-Zn sulphide/oxide mineralization at depth. Iron sulphide, graphite, alteration zones and other geological structures (e.g. magnetic dykes, intrusive bodies, faults, etc) may also produce similar responses. A combination of the aforementioned factors is also possible and alternative source of the interpreted responses. The anomalous zones presented in this report have been outlined from each individual inversion model and grouped in zones according to the Titan target classification presented previously.

The following figures present a summary of the interpreted zones and targets in plan views of the 2D DC, IP and MT Resistivity. The maps also include the recommended drillholes, interpreted structures and known mineralization in the property. Details on the properties and location of the interpreted anomalies are supplied in the following. Maps and sections are also available in Appendices E, F and G.

#### 3.4.1 Geophysical Interpretation Summary

Based on the IP chargeability inversion models and the DC and MT resistivity association, a total of eight (8) anomalous zones have been identified for follow up at Ketz River Project from near surface to approximately 700 meters depth. Of all the interpreted DC/IP and MT zones, five (T1, T2, T4, T6 and T8) have been classified as high priority targets, and three zones (T3, T5 and T7) are classified as second priority targets, Figure 9 to Figure 14.

Alternatively, the MT inversion models show good resolution of the anomalies to about 2000 meters depth. Three MT resistivity low anomalies (MT-1 to MT-3) have been delineated as significant targets for deep exploration in the property.

In general, the interpreted Titan DC/IP and MT anomalies successfully correlate with the major manto-type sulfide/oxide, quartz -sulfide fissure veins and quartz-breccia mineral zones discovered at Ketz River property. Also, a good resolution of the geological contacts, lineaments and structures was achieved in plan and at depth. The north-west trending fault systems (e.g. Peel Ridge and East Side faults) and geological contacts are well explained by the sub-vertical low resistivity features and gradient zones interpreted from the DC/IP and MT inversion models. A good resolution of the limits of the oxidation zone to approximately 300 meters depth was also achieved by the inversions.

The anomalous zones T1, T4 and T5 are located in the shallower part of the sections above the interpreted oxidation horizon. Furthermore, zone T2 extends beyond the interpreted oxidation horizon at depth >700 meters indicating structural controlled mineralization.

On the western part of the grid, the Titan anomaly T1 is well explained by the known mineralized zones documented in the National Instrument as Lab, Hoodoo and Cornet zones. In general, these anomalies are sub-horizontal and limited at depth to about 300 meters. They occupy large area in the sections, and are possibly related to the oxidation zone and sub-vertical structures.

In the central part of the survey area, the most intense chargeability anomaly (T2) is associated with moderate to low DC and MT resistivity responses. This anomaly suggest an extension of the Ridge and Crest manto-type mineral zones documented south and east form L0N. The lower part of the anomaly indicates structural controlled sulphide mineralization.

The moderate to weak chargeability response (T3) in the central part of the survey area is associated with DC and MT resistivity moderate responses, possibly indicating stringer to disseminated copper-zinc and gold mineralization and/or alteration. The variations on the amplitude of the chargeability and resistivity responses within the interpreted zone suggest mineral and/or geological differentiation. This anomalous zone may be an indication of the continuity of the Fred's vein-like mineralization located a few hundred meters south from L0N.

Anomaly T4 is located in the eastern part of the survey grid on the western slope of the Shamrock Mountain. The IP response is strong with DC and MT resistivity low, suggesting significant mineralization. The presence of the Gully mineralized zone over this area suggests potential for quartz-sulfide vein like mineralization.

Anomaly T5 is a weak to moderate chargeability anomaly located on the eastern part of the survey grid on the eastern slope of the Shamrock Mountain and extends at depth from near surface to about 300 meters. The DC resistivity is moderate indicating disseminated mineralization. The south-western part of the response on L0N may be related to the mineral zone and structures documented as the 3M zone, which consists of quartz breccia and disseminations in siliciclastic rocks. The zone is located on the ridge between Peel and Misery Creeks.

Zones T6, T7 and T8 are located in the deeper part of the sections below the interpreted oxidation horizon.

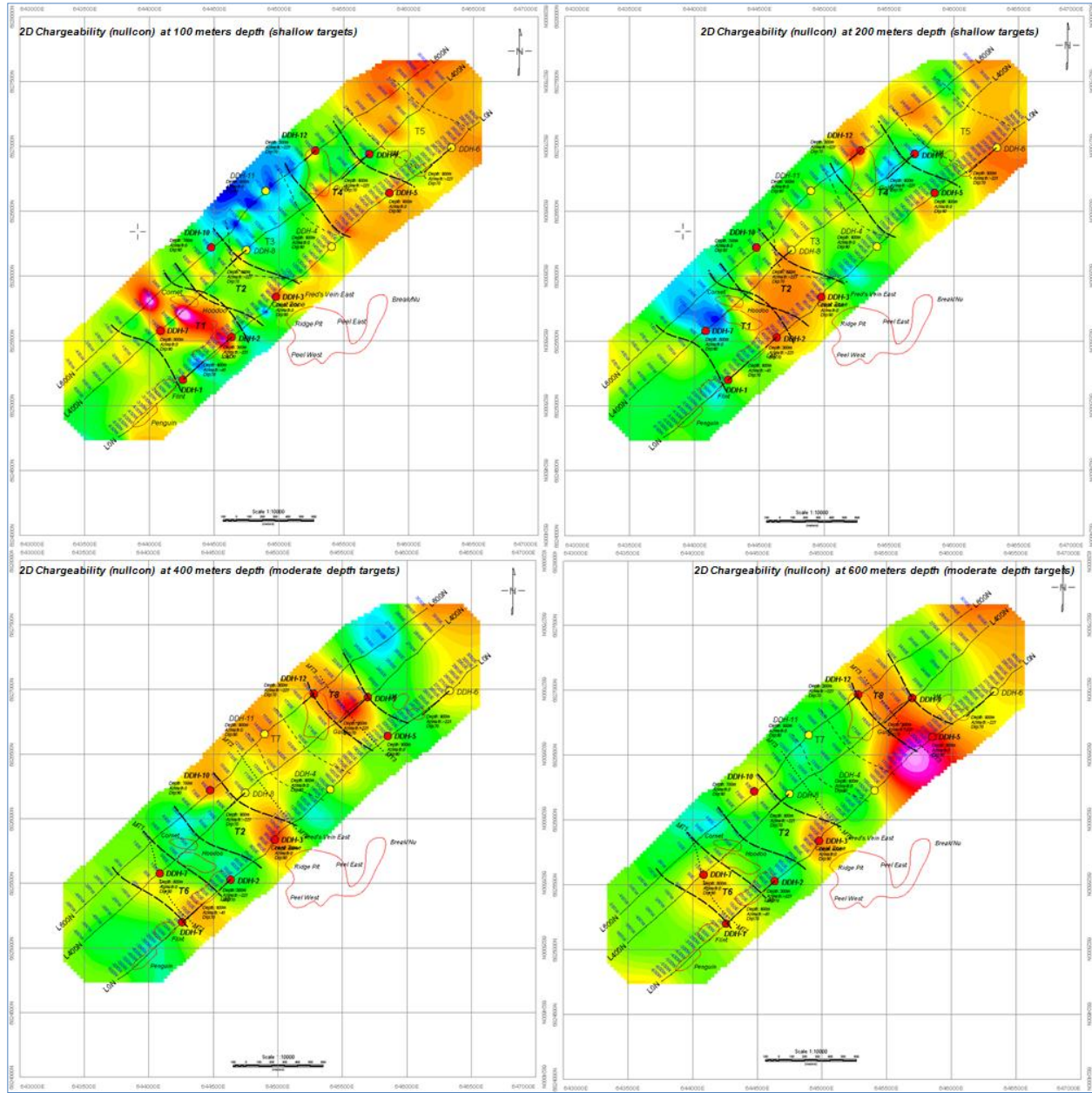
Anomaly T6 is located on the western part of the grid at depth from approximately 300 meters to about 700 meters. This zone is a moderate area, moderate IP response with moderate to high DC resistivity response. Contrary to the DC, the MT resistivity indicates the presence of a large conductive structure related to this anomaly, suggesting potential target for deep structural controlled sulfide mineralization.

Anomaly T7 is a MT resistivity low anomaly associated to a weak IP response. This zone is located in the central part of the survey grid at depth from approximately 300 meters to about 700 meters depth. The DC and MT resistivity varies significantly from the south (L0N, L400N) to the north (L600) indicating geological and/or mineral differentiation.

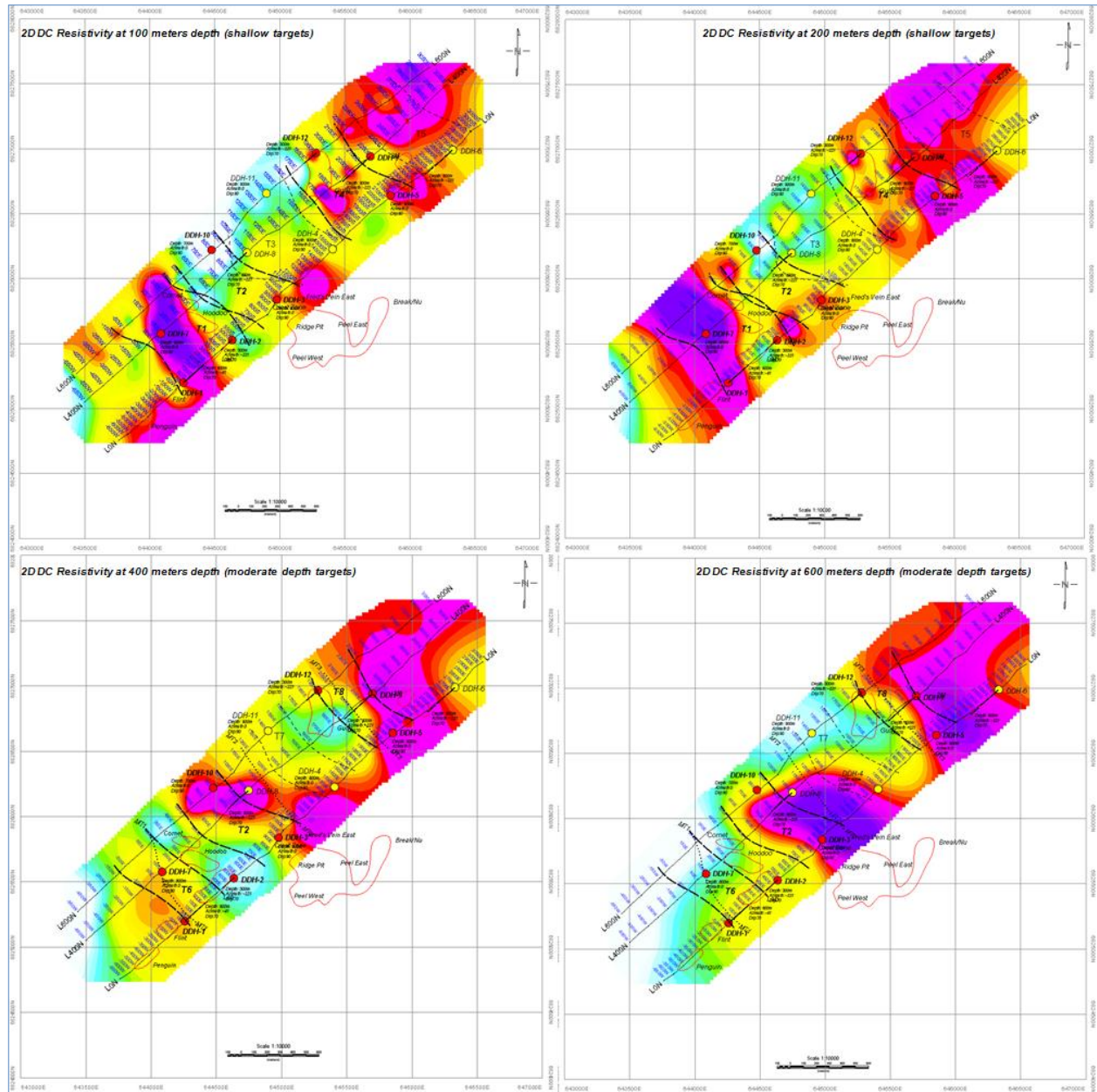
Anomaly T8 is are large area moderate to strong IP response located in the eastern part of the survey grid at depth from approximately 300 meters to about 800m depth. The DC and MT resistivity is generally low and may be related to significant sulfide mineralization and/or alteration at depth, but also it may be related to structural formations such as sub-vertical faults and geological contacts.

The interpreted deep MT resistivity low anomalies (MT-1, MT-2 and MT-3) below and in the vicinity of the shallower multiparameter Titan anomalous zones suggests the presence of significant sulphide mineralization and/or alteration zones within feeder channels at depths from 500 to >1200 meters. These deep MT responses are also expected to be geologically and structurally controlled.

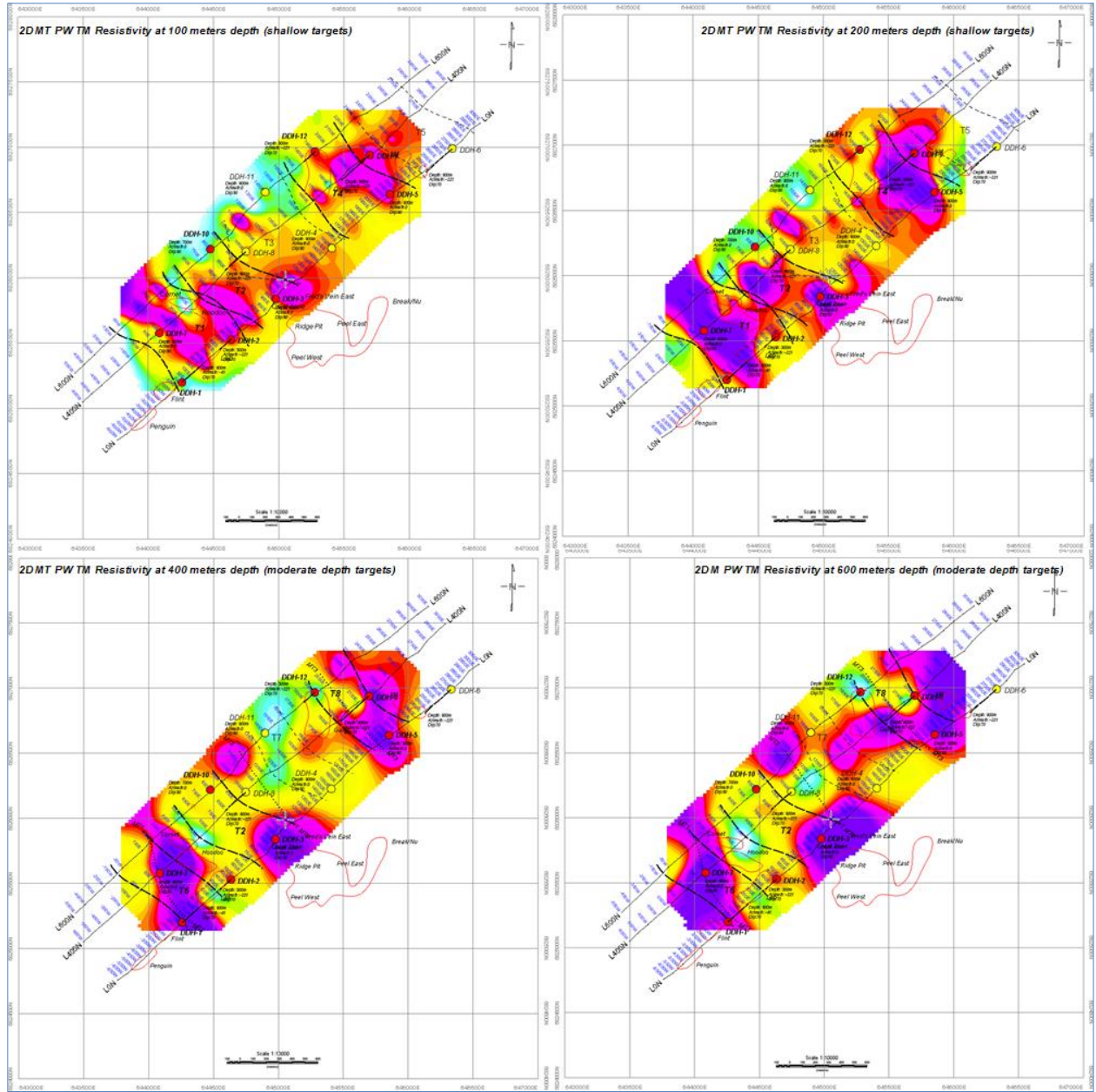
In general, a total of twelve (12) drillholes have been recommended to test the first and second priority targets interpreted in the property. A more detailed description of the parameters, extent, possible mineral association and suggestions for drill targeting the interpreted Titan anomalies are supplied in the following sections. Additional information of the interpreted anomalies and drillhole targets are also available in Appendix F.



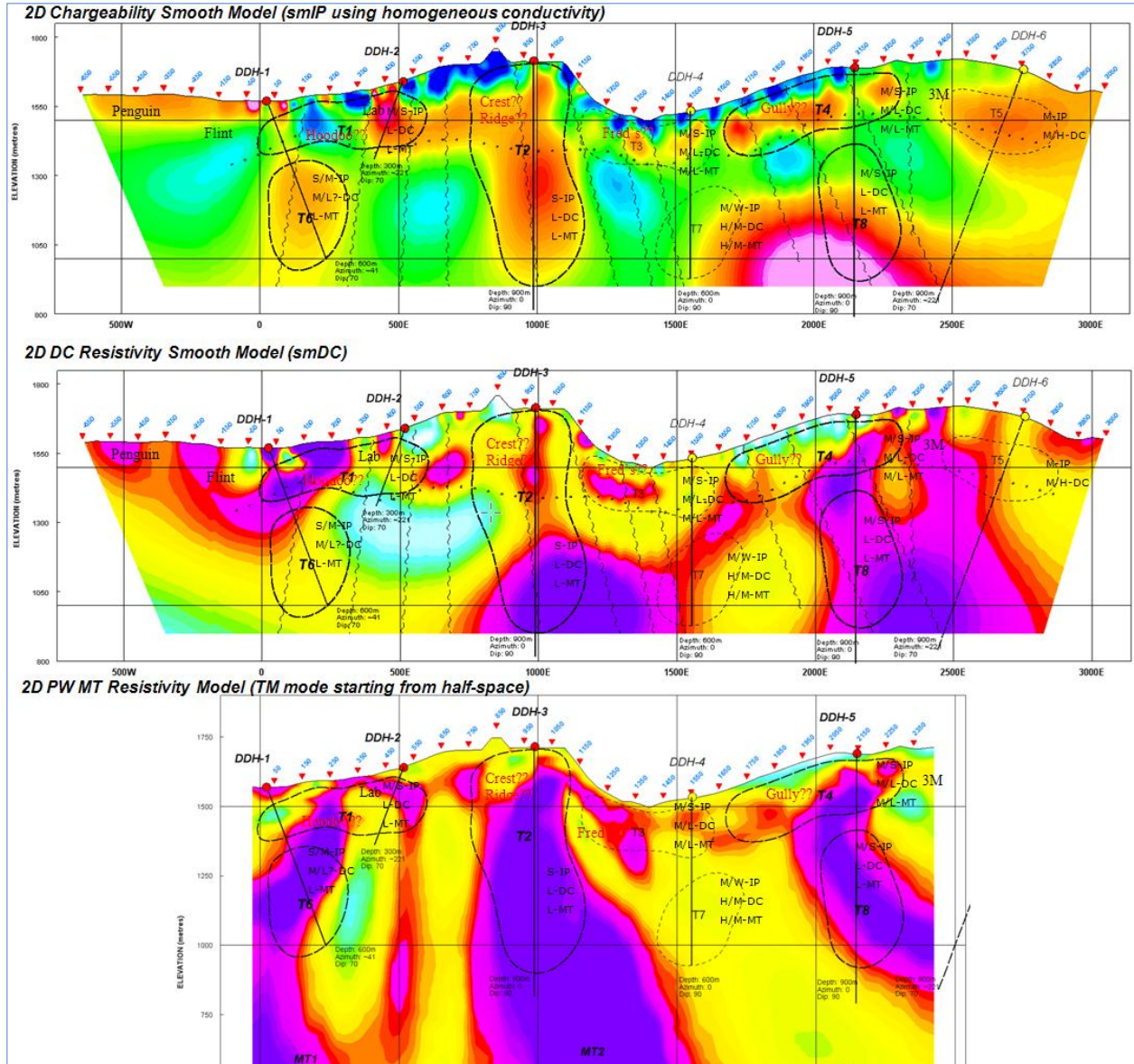
**Figure 9: Interpretation Plans over 2D IP (nullcon) at 100, 200, 400 and 600 meters depth**



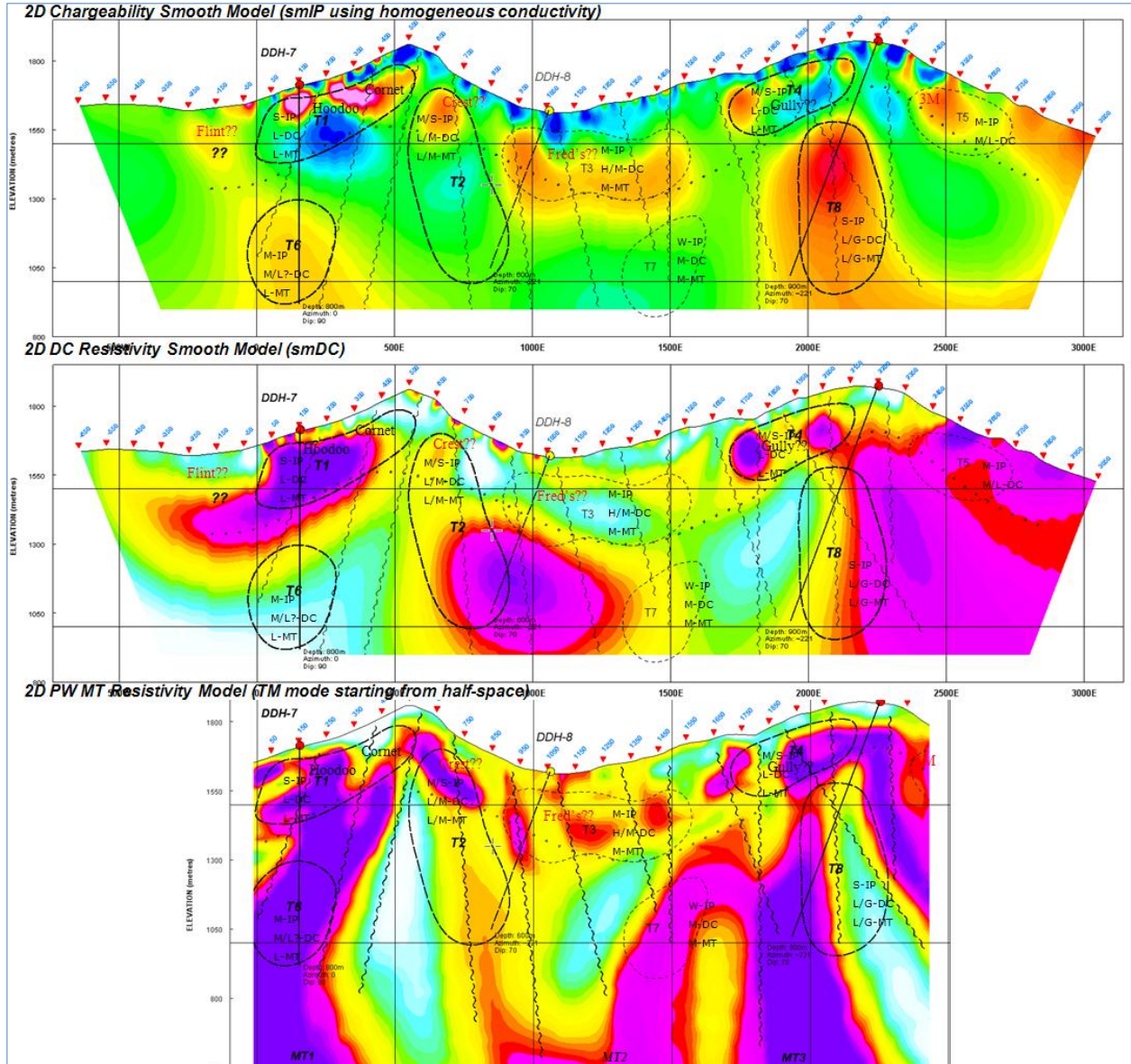
**Figure 10: Interpretation Plans over 2D DC Resistivity at 100, 200, 400 and 600 meters depth**



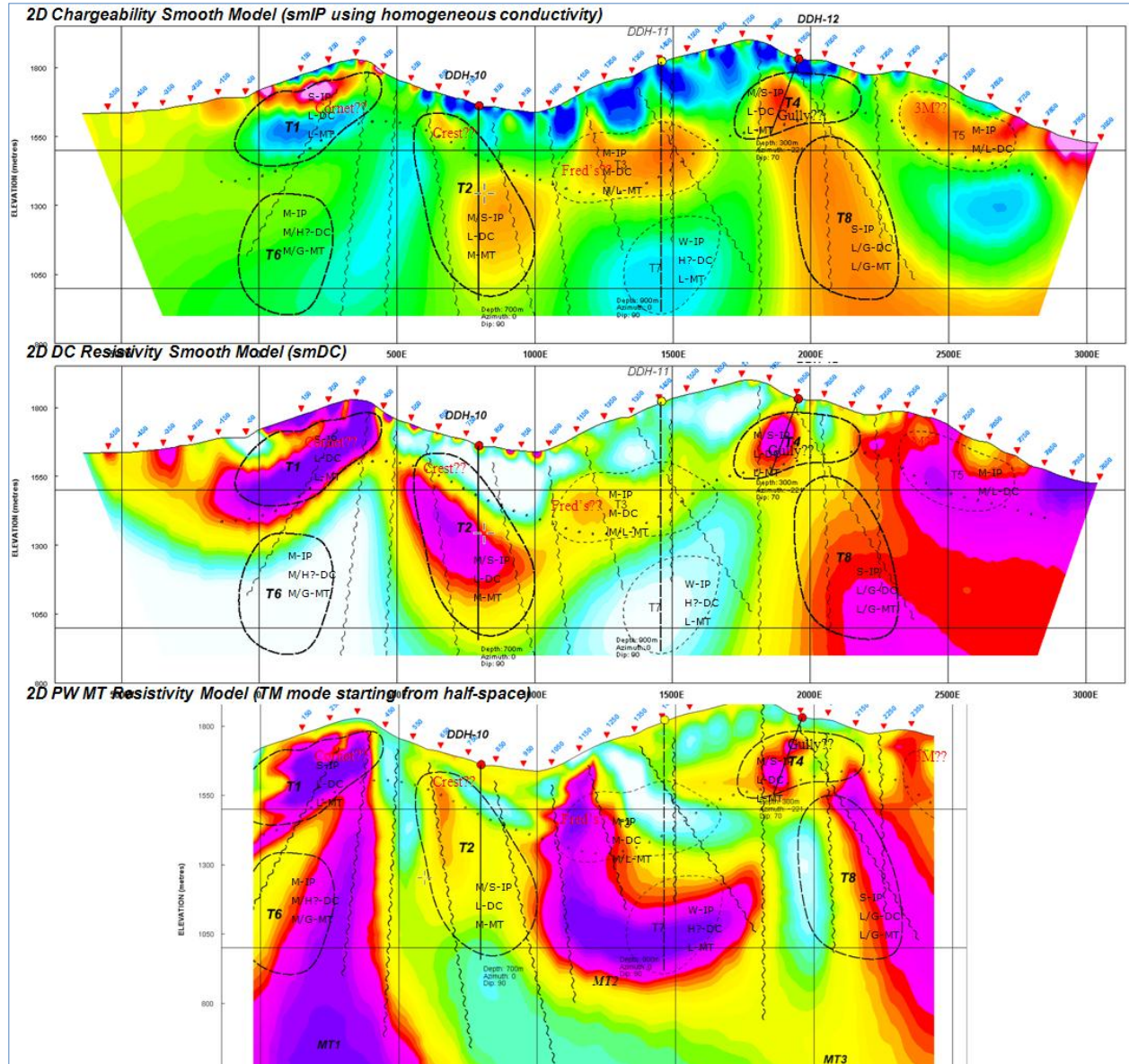
**Figure 11: Interpretation Plans over 2D MT Resistivity at 100, 200, 400 and 600 meters depth**



**Figure 12: DC/IP and MT Interpreted Sections for LON**



**Figure 13: DC/IP and MT Interpreted Sections for L400N**



**Figure 14: DC/IP and MT Interpreted Sections for L600N**

### 3.4.2 First Priority Anomalous Zone T1

Anomaly T1 is a sub-horizontal, large area (>600mx600m) DC/IP and MT response located in the western part of the survey grid, on the western slope of Peel Ridge. This zone strikes northwest from line L0N (station 0E to 600E) to line L600N (station -150W to 450E). This zone extends at depth from near surface to a maximum of approximately 300 meters, Figure 9 to Figure 14.

The most intense portions of the IP response (>50 milliradians) are located on the northern (from ~0E to ~250E) and on the southern parts of the anomaly (from ~300E to 600E). The DC and MT resistivity is moderate (>100 Ohm-meters) for the north part, suggesting disseminated to stringer sulphide/oxide mineralization. On the southern part the DC and MT resistivity is low (<100 Ohm-meters) indicating more massive mineralization.

Several sub-vertical contact zones and/or fault systems are interpreted crosscutting the center and the eastern parts of the anomaly from near surface to depth >700 meters. Below T1, particularly on the south part of the anomaly, there is a significant increase of the conductivity suggesting potential for deep exploration. This zone may be related to the underlying anomaly T6. The MT resistivity low anomaly MT-1 supports the depth extent of the shallow multiparameter anomaly T1 and T6.

No geological information is available to determine the host rocks for T1. According to the information compiled from the National Instrument, this zone successfully correlate with the Lab mineral zone to the south (L0N) and with the Hoodoo and Cornet zones to the north (L400N and L600N).

The Lab zone is a gold-rich carbonate-hosted chimney and manto-style sulfide mineralization on the southern slope of Peel Ridge. The Lab zone consists of four distinct zones that occur over an area measuring 320m x 400m and average 5m in thickness. On L400N and L600N anomaly T1 corresponds with the Hoodoo and Cornet mineral zones which are manto-style oxide/sulfide mineralization located on the southern slope of Peel Ridge. Geometrically the Hoodoo zone is a flattened cylinder (Russ, W. & Leah, M. (2008).

The position of this zone above the interpreted lower limit of the oxidation zone, along with the sub-horizontal structure of the response suggests potential for oxide/sulfide manto type mineralization. The large area of this zone, along with the strong to moderate amplitude of the IP response and the low DC and MT resistivity association make this zone a first priority target for further exploration over the unexplored areas.

Three drillholes are proposed to test this zone. Drillholes DHH-1 and DDH-2 are located on L0N at stations 0E and 500E. These two holes are intended for targeting the southern and northern parts of the anomaly. Drillhole DDH-7 is located on L400N at station 150E, and it is proposed for targeting the central part of the anomaly.

### 3.4.3 First Priority Anomalous Zone T2

Anomaly T2 is a sub-vertical, large area (>400mx600m) DC/IP and MT response located in the central part of the survey grid, below and slightly to the east side of the Peel Ridge. This zone strikes northwest from line L0N (station 750E to 1100E) to line L600N (station 550E to 950E), Figure 9 to Figure 14. This zone extends at depth from near surface to approximately 800 meters, Figure 9 to Figure 14.

This response is potentially related to at least two sources of mineralization and/or alteration. The first one is located at depth from near surface to about 300 meters depth. The IP response is limited in area with moderate to strong chargeability values (40-60 milliradians). The DC resistivity is moderate to low (100-1000 Ohm-meters) suggesting disseminated to weak oxide/sulfide manto type of mineralization.

The second part of the anomaly is a large area, moderate to strong IP response (40-60 milliradians) located from 300 meters to about 800 meters depth. The DC and MT indicate a large area resistivity low response related to this part of the anomaly (<100 Ohm-meters). The inversion models suggest that the source may extend significantly to the east and at depth. The MT inversion models delineate a large area resistivity low (MT-2) extending at >800 meters suggesting the presence of structurally controlled sulfide mineralization, sub-vertical structures and/or alteration.

The IP chargeability response for T2 is of larger area and stronger on the southern part of the grid (>50 milliradians) and it is associated with DC and MT low resistivity responses (<100 ohm-meters). The deep portion of the resistivity response, particularly to the south is possibly related to deep mineralization. To the north, the moderate to low resistivity association suggests semi-massive to stringer mineralization and/or alteration. The most intense portion of the IP response related to more conductive zones suggest more massive mineralization and/or high copper content.

The MT inversion models suggest strong structural control. At depths >500 meters, the anomaly T2 and the MT resistivity low anomaly MT-2 below and to the east may have the same deep structural control. Significant sulphide mineralization and alteration zones within feeder channels at depths from 500 to >1000 meters are also expected to be encountered.

No geological information is available to define the host rocks over this area. The Ridge and Crest mineral zones documented south and east of T2 (L0N) suggest that mineralization may extend to the north and west. The Ridge oxide manto zone consists of three nearly flat-lying separate mineralized bodies occurring over an area approximately 500m in length, 85m in width and 50m in thickness. Oxide mineralization is cut off by northwest-trending East Side fault (Russ, W. & Leah, M. (2008).

At least two sub-vertical fault zones and/or structures are interpreted to crosscut the center and the eastern parts of T2 from near surface to depth >700 meters. These zones are potentially related to the East Side fault documented in the National Instrument.

Based on the favorable DC/IP and MT responses and the potential association with the Ridge and Crest mineral discoveries, zone T2 is interpreted as a first priority target for further exploration on the property. Three drillholes are proposed to test the most significant portions of the DC/IP and MT multiparameter anomaly T2, and also the top part of the deep MT resistivity low anomaly MT-2. Drillhole DDH-3 is located on line L0N at 1000E. Drillhole DHH-8 (optional as a second priority) is located on L400N at station 1050E; and drillhole DDH-10 on L600N at station 800E.

#### 3.4.4 Second Priority Anomalous Zone T3

Anomaly T3 is a sub-horizontal moderate to large size (~500x600m) IP response located in the central part of the survey grid from L0N (station 1200E to 1600E) to line L600N (station 1100E to 1600E). This Titan anomaly is shallower on L0N and limited to about 300 meters depth. To the north (L600N) the anomaly is deeper and limited at depth to about 500 meters. The available information indicates that T3 is located on the north-east side of Peel Ridge in the Peel Creek drainage area, Figure 9 to Figure 14.

In general, the chargeability values are moderate (20-40 milliradians) and the DC and MT resistivity responses are moderate to high with values <1000 Ohm-meters. The most significant portion of the IP response (>40 milliradians) is observed to the north and extends at depth from ~200 meters to >500 meters.

On L600N, the DC and MT inversions delineate a moderate-low resistivity response (<300 Ohm-meters) associated with the center of the IP response. Particularly on the south portion of the anomaly, the MT resistivity models show a significant increase on the conductivity, which may be related to the sub-vertical response MT-2. This may be an indication of significant sulfide mineralization at depth. Over this area, the anomaly is located slightly towards the southern flank of Shamrock Mountain in the Peel Creek drainage, possibly in the lower limits of the oxidation/sulfidation zone.

For the top part of the anomaly, the presence of small size IP responses with low DC and MT resistivity suggest discrete mineral intervals within the oxidation zone. The central and lower part of the anomaly is commonly a large area strong IP response with DC and MT resistivity moderate responses indicating more disseminated to stringer mineralization.

This anomaly is possibly related to various sub-vertical structures, faults and alteration. The Fred's Vein East located south from L0N is an indication for potential sulfide vein-like mineralization. Significant sulphide/oxide mineralization may be the source of anomaly T3, although a second priority was assigned to this anomalous zone due to the moderate IP response and the DC and MT moderate to high resistivity association.

Three drillholes are proposed to test this anomaly. Drillhole DDH-4 is located on line L0N at 1550E, and it is proposed to test the eastern part of T3 and the deep anomaly of T7. Drillhole DDH-8 is located on L400N at station 1050E for testing the southern portion of the anomaly and the deep part of T2. Drillhole DDH-11 is located on L600N at station 1450E in order to test in the central and eastern part of the anomaly and anomaly T7 below.

#### 3.4.5 First Priority Anomalous Zone T4

Zone T4 is one of the most significant targets interpreted at Ketz River property. This is a sub-horizontal large area (>600x600m) strong IP response (>60 milliradians) located in the eastern part of the survey grid on the western slope of the Shamrock Mountain. This zone strikes northwest from line L0N (from station 1560E to 2250E) to L600N (station 1600E to 2200E) and extends at depth from near surface to about 300 meters depth, Figure 9 to Figure 14.

The IP response for T4 is strong (>60 milliradians) with DC and MT resistivity low (<100 Ohm-meters) suggesting significant sulphide/oxide and/or associated gold mineralization. The resistivity models indicate that there are least two or more discrete mineral sources related to this response, particularly resolved on the west and east part of the anomaly.

Several sub-vertical structures are interpreted to crosscut this anomaly as indicated in the DC and MT resistivity models. The Gully mineralized zone over this area, particularly on the western part of the anomaly (from L400N to L600N) suggests potential for quartz-sulfide vein like mineralization. The Gully mineralized zone occurs in siliciclastic rocks north of the Peel fault.

To the east, the DC and MT resistivity inversion models delineate a sub-vertical gradient and a resistivity low anomaly (<100 ohm-meters) below T4, suggesting a structural control over this part of the anomaly. Several drillholes seem to have tested the northern part of this anomaly, although potential for sulphide mineralization still exists over the unexplored areas and at depth beyond the limits of the Gully mineral zone.

Based on the strong IP response and the DC and MT resistivity low association, a high priority for targeting sulphide/oxide and gold mineralization was assigned to anomaly T4. Two drillholes are recommended to test the anomalous zone T4. DDH-5 located on line L0N at station 2150E and DDH-12 located on line L600N at station 1950E. Another drillhole (DDH-9) located on L400N at station 2250E may also test the deep and eastern extent of T4.

#### 3.4.6 Second Priority Anomalous Zone T5

Zone T5 is a second priority target interpreted at Ketz River property. This is a sub-horizontal moderate area (<500mx600m) IP response located in the eastern part of the survey grid on the eastern slope of the Shamrock Mountain. This zone strikes northwest from line L0N (from station 2450E to 2900E) to L600N (station 2350E to 2700E) and extends from approximately 50 meters to about 300 meters depth, Figure 9 to Figure 14.

Anomaly T5 is basically a weak to moderate chargeability response with values between 20 and 40 milliradians. The south-western part of the response (on L0N) may be related to the 3M mineralization zone, which consists of quartz breccia and disseminations in siliciclastic rocks. The 3M zone is located on the ridge between Peel and Misery Creeks.

On the north part of the response (L600N) the resistivity is low with values <100 Ohm-meters indicating more massive mineralization. To the south, the resistivity is moderate (>300 ohm-meters) suggesting mineral dissemination. According to the structural interpretation derived from the resistivity sections, the most intense chargeability areas of T5 are located in the oxidized zone.

For all the lines, the DC inversion models show a strong sub-vertical resistivity low anomaly (<100 Ohm-meters) located at approximately 200 meters west of T5 and east from T8, with no significant chargeability response. This may be an indication of structurally controlled mineralization and/or major fault system in this area. Few drillholes are documented over this anomalous zone, particularly to the north and northeast where potential for sulphide mineralization still exist.

A second priority was assigned to T5 based on the weak amplitude of the IP response and the moderate-high resistivity association. One drillhole (DDH-6) is recommended for testing T5 on line L0N near to station 2750E.

#### 3.4.7 First Priority Anomalous Zone T6

Zones T6 is a first priority target located in the deeper part of the sections below the interpreted oxidation horizon. This zone is located on the western part of the grid. The central axis of the anomaly strikes northwest from line L0N (from station 50E to 350E) to line L600N (from station 100W to 250E). This target is a moderate size zone (<400m x 600m) observed from >300 meters to approximately 800 meters in depth, Figure 9 to Figure 14.

The chargeability response is moderate (20-50 milliradians) with moderate to high DC resistivity response (>300 Ohm-meters). Contrary to the DC, the MT resistivity indicates the presence of a large conductive structure (<100 Ohm-meters) related to this anomaly. The MT resistivity low suggests a potential target for deep sulfide mineralization and/or alteration.

The top part of the anomaly (on L400N and L600N) may corresponds with the Hoodoo and Cornet mineral zones which are manto-style oxide/sulfide mineralization located on the western slope of Peel Ridge. The sulphide mineralization is underlying the oxide mineralization and may extend at depth >300 meters where the center of the IP response is located.

To the south (on L600N) the anomaly is weaker (<30 milliradians) and with a moderate-to-high gradient resistivity association (<500 ohm-meters). This may indicate low sulphide content and/or weak-disseminated mineralization. On the northern part of the anomaly, from L400N to L0N the IP response is stronger and extends to depths >500 meters. Over this area the DC and MT resistivity is lower (<300 Ohm-meters) suggesting more massive sulphide mineralization.

The interpreted contact zones and/or fault systems related to this target zone may extend to depths >500 meters and has potential for sulfide mineralization along strike and at depth >300 meters. Two drillholes (DDH-1 on L0N at station 0E and DDH-7 on line L400N at station 150E) are recommended for testing the unexplored zones of anomaly T6.

#### 3.4.8 Second Priority Anomalous Zone T7

Anomaly T7 is basically a MT resistivity low (<100 Ohm-meters) anomaly with a weak IP response (<20 milliradians). This zone is located in the central part of the survey grid. The DC resistivity varies from moderate to high (>300 Ohm-meters). This zone is situated in the deeper part of the sections below the oxidation horizon. The center of the anomaly strikes northwest from L0N (from station 1250E to 1900E) to L600N (from station 1300E to 1950E, Figure 9 to Figure 14).

According to the inversion models, the top part of the response is at approximately 300 meters and extends to approximately 700 meters in depth on L600N. On L0N the full extent of the IP response is not well resolved due to the presence of a large chargeability response to east. For L400N and L600N the MT inversion models delineate a significant resistivity low response (<100 Ohm-meters) with no IP and/or DC resistivity low association.

The MT resistivity indicates the presence of a large conductive structure related to this anomaly, suggesting potential target for deep structural controlled sulfide mineralization. The DC and MT resistivity varies significantly from the south (L0N, L400N) to the north (L600) indicating geological and/or mineral differentiation. Limited potential for mineralization is expected for this anomaly.

A second priority was assigned to T7. Two drillholes are recommended to this zone. Drillhole DDH-4 is located on line L0N at station 1550E, and Drillhole DDH-11 is located on line L600N at station 1450E.

### 3.4.9 First Priority Anomalous Zone T8

Anomaly T8 is a first priority target zone and one of the most significant responses located on the eastern part of the survey grid. This zone is a large size (>400mx600m) sub-vertical IP anomaly located from line L0N (from station 2000E to 2350E) to L600N (from station 1950E to 2350E). Zone T8 is located in the deeper part of the sections below the interpreted oxidation horizon and below the high priority anomaly T4. The IP response extends to depth from approximately 300 meters to >800 meters, Figure 9 to Figure 14.

The chargeability response is strong (>50 milliradians). The DC and MT resistivity is generally low (<100 Ohm-meters) and may be related to significant sulfide mineralization and/or alteration at depth. The gradient resistivity zones suggest that T8 may be related to structural formations such as sub-vertical faults and geological contacts.

The deep MT resistivity low anomaly MT-3 suggests a close relation with the source of anomaly T8. Significant sulphide mineralization and/or alteration zones may be encountered at depths from >1200 meters. These deep MT responses are also expected to be geologically and structurally controlled.

The most intense portion of the chargeability response is observed from line L0N to L600N and possibly corresponds to the lower and eastern part of the Gully mineralized zone and/or controlling structure. Over this area, the resistivity low (<100 Ohm-meters) suggests massive sulfide mineralization at depth. The moderate to high gradient resistivity (>500 Ohm-meters) indicates semi-massive to disseminate mineralization.

The Gully mineral zone may be the source for this anomaly, although potential for sulphide mineralization still remains open at depths >400 meters and along strike to the south. This anomaly may also be related to gold and significant sulphide mineralization located in major fracture/contact systems and alteration zones on the unexplored areas.

A high priority was assigned to T5. Two drillholes are recommended to test this anomaly. DDH-5 is located on line L0N at station 2150E and drillhole DDH-9 is located on L400N at station 2250E.

### **3.5 DEEP MT TARGETS FROM 500 TO 2000 METERS DEPTH**

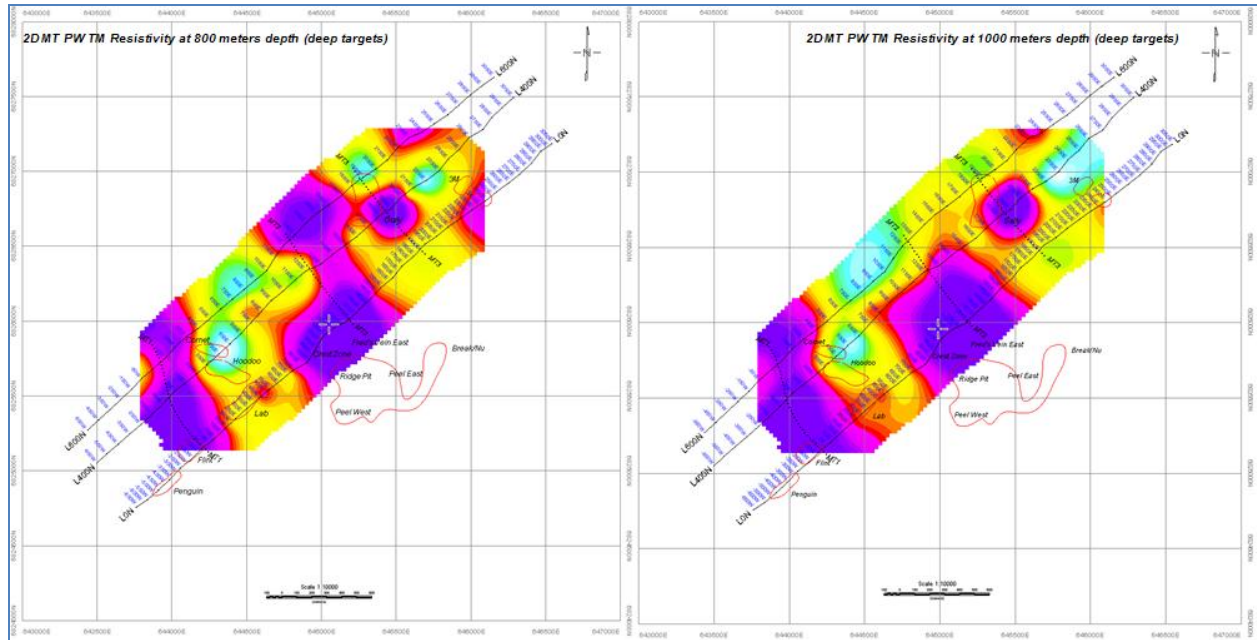
Three MT resistivity anomalies (MT-1 to MT-3) have been identified as significant targets for exploration from 700 to ~2000 meters depth. The interpreted deep MT targets represent resistivity low anomalies (<100 ohm-meters) that may be associated with sub-vertical and structurally controlled mineralization and/or alteration at depth (Figure 15).

A second priority was assigned to the deep MT anomalies due to the large depth of the targets and the inexistence of DC/IP coverage, drillhole information and conventional geophysical data to corroborate the interpretation. The MT resistivity responses MT-1 and MT-3 represent the most significant MT targets for deep exploration on the property. Anomalies MT-2 is a lower priority target for deep exploration at Ketz River.

Zone MT-1 is situated on the western part of the survey grid. The central axis of the anomaly is located from L0N at station -500W to line L600N at station ~150E. The most significant portion of this MT response (<100 Ohm-meters) is situated at >900 meters depth from L400N to L600N.

Zone MT-2 is situated on the central part of the survey grid from L0N at station 1250E to line L600N at station 1250E. This is a large area resistivity low (<100 Ohm-meters) response located at depth from 800 meters to a maximum of 1300 meters. The most significant portion of this MT response (<100 Ohm-meters) is situated at >700 meters depth on L0N.

Zone MT-3 is on the eastern part of the grid from L0N at station 1900E to line L600N at station 1950E. This MT anomaly is a large area resistivity low (<100 Ohm-meters) response located at depth from 500 meters to >1200 meters. On L0N and L6N this response is significantly limited at depth.



**Figure 15: Interpretation Plans over 2D MT Resistivity at 800 and 1000 meters depth**

In addition to the deep MT target interpretation (MT-1 to MT-3), the inversion models have also resolve several sub-vertical lineaments and gradient zones crosscutting the interpreted near surface target zones. These interpreted structures basically have north and northwest azimuth, and may be possibly associated to deep feeder channels, geological contacts and fault systems.

In cases where the deep MT anomalies (either conductive or resistive gradient zones) are an extension of the shallower DC/IP chargeability and MT anomalies, a higher priority may be assigned to these responses if significant results are encountered when targeting the shallower anomalies. If mineralization is encountered when drilling the anomalies above the deep MT targets, extending the drilling should be considered as a higher priority.

The unrotated PW TM inversion models preferentially accentuated the geological signatures and potential mineralization along the geological dip direction. A good resolution of the geological contacts was also achieved by the unrotated PW TMTE from a half space and PW TMTE from the stitched 1D determinant inversion. For details on these MT inversion models and interpretation refer to previous sections and Appendix E. Additional information on the interpretation, inversion parameters and models including alternate plan maps and sections are also available in the digital archive and Appendices F and G.

## 4. CONCLUSION AND RECOMMENDATIONS

### 4.1 CONCLUSION

At Ketz River Project, the Titan-24 survey has successfully identified at least eight geophysical anomalies (T1 to T8) in the DC/IP and MT raw data and inversion models with potential for polymetallic (Ag-Cu-Zn) manto type and gold mineralization from near surface to approximately 700 meters depth. Of all the interpreted DC/IP and MT zones, five anomalies (T1, T2, T4, T6 and T8) have been classified as high priority targets, and three zones (T3, T5 and T7) are classified as second priority targets.

The MT inversion models show good resolution of the anomalies to about 2000 meters depth. Three MT resistivity low anomalies (MT-1 to MT-3) have been delineated as significant targets for deep exploration in the property.

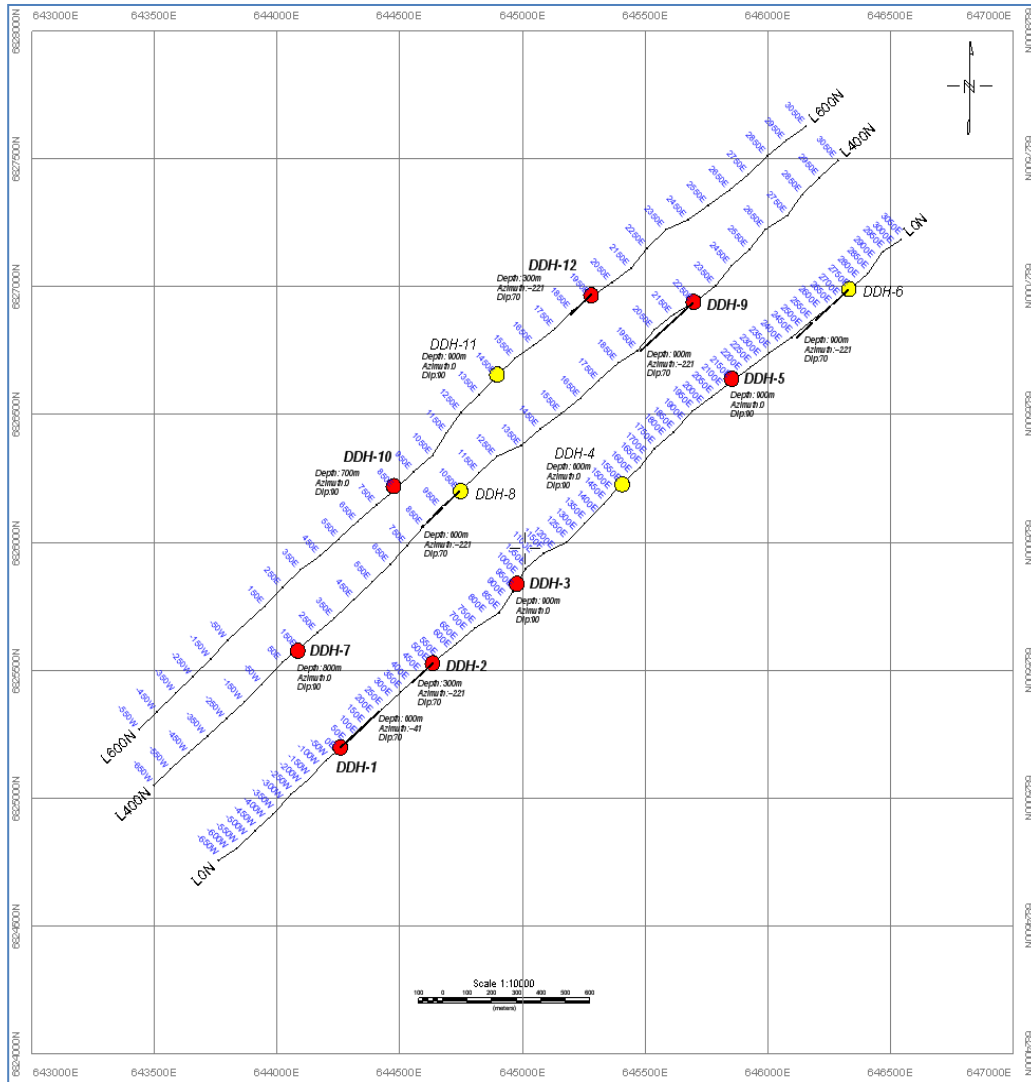
The interpreted deep MT resistivity low anomalies bellow and in the vicinity of the shallower Titan anomalous zones suggest the presence of significant mineralization and/or alteration zones within feeder channels at depths from 500 to >1200 meters. These deep MT responses are expected to be geologically and structurally controlled.

A second priority was assigned to the deep MT anomalies due to the depth of the targets, the limited coverage of the DC resistivity and IP chargeability at depth, and the inexistence of drillhole and/or geophysical data to corroborate the interpretation. In cases where the low MT resistivity responses are an extension of the shallower DC/IP chargeability, a higher priority may be assigned to these responses if significant results are intersected by the recommended drill holes.

The DC/IP & MT interpretation could possibly be affected by 3D and other linear structures (faults, veins, dykes, etc), which may run parallel and/or sub-parallel to the survey lines. The DC/IP and MT model interpretation and target prioritization was mainly based on the anomaly amplitude, extent and multi-parameter association.

The interpreted anomalies may not necessarily be directly related to gold and sulphide/oxide manto mineralization. Other sources, such as iron-rich formations, graphite and clay fault systems could produce similar DC/IP and MT responses.

A total of twelve (12) drillholes have been recommended to test the first and second priority targets interpreted in the property. The following table (Table 1) and figure (Figure 16) summarize the location and parameters of the proposed drillholes for testing the interpreted anomalous zones.



**Figure 16: Plan Map with location of the Drillhole Targets at Ketza River Project**

Hole ID	Priority	UTME	UTMN	Depth	Azimuth	Dip	Target	Line	Station
DDH-1	1st	644255.9	6825200.9	600	41	70	T1, T6	L0N	25E
DDH-2	1st	644629.1	6825529.6	300	221	70	T1	L0N	500E
DDH-3	1st	644972.6	6825843.5	900	0	90	T2	L0N	975E
DDH-4*	2nd	645405.0	6826231.5	600	0	90	T3, T7	L0N	1550E
DDH-5	1st	645852.2	6826646.1	900	0	90	T4, T8	L0N	2150E
DDH-6*	2nd	646326.1	6826992.6	900	221	70	T5	L0N	2750E
DDH-7	1st	644078.3	6825582.9	800	0	90	T1, T6	L400N	150E
DDH-8*	2nd	644744.6	6826207.8	600	221	70	T3, T2	L400N	1050E
DDH-9	1st	645695.3	6826948.2	900	221	70	T8, T4?	L400N	2250E
DDH-10	1st	644475.1	6826216.7	700	0	90	T2	L600N	850E
DDH-11*	2nd	644898.6	6826663.9	900	0	90	T3, T7	L600N	1450E
DDH-12	1st	645280.6	6826971.9	300	221	70	T4	L600N	1950E

**Table 1: Recommended Drillhole Targets at Ketza River Project**

## 4.2 RECOMMENDATIONS

The following recommendations are derived from the interpretation of the DC/IP and MT survey at Ketza River Project:

1. Drill-test the top and center portions of the interpreted high priority anomalies, and if favorable drill results are obtained, then drill test the deep portion and unexplored areas in the vicinity of the chargeability anomalies where significant DC and MT resistivity responses are observed.
2. Review and evaluate all the available geophysical, geological and geochemical data in the vicinity of the priority target areas prior to drilling and commencing further exploration of these zones.
3. If mineralization is encountered during drilling the anomalies above the deep MT targets, consider extending the holes to test these responses.
4. When the deep targets are drilled, follow up with downhole BHTEM and consider physical property logging on all the targets in order to delineate the extent of the source and/or identify secondary sources of the anomalies.
5. Evaluate and re-interpret the existing conventional surface and borehole geophysical data to further enhance the interpretation and drill targeting.

RESPECTFULLY SUBMITTED BY QUANTEC GEOSCIENCE LTD.

*[signed and sealed]*  
Evelio Martinez del Pino, M.Sc., P. Geo (ON)  
Senior Geophysicist  
Geophysical Interpretation Group  
Quantec Geoscience Ltd.



*[signed]*  
Kevin Killin, H.B.Sc.  
Manager  
Geophysical Interpretation Group  
Quantec Geoscience Ltd.

Toronto, Ontario  
November, 2009

## 5. GLOSSARY OF ACRONYMS AND ABBREVIATIONS

- Titan-24 (or Titan): Quantec Geoscience proprietary Distributed Acquisition System.
- DAS: Distributed Acquisition System.
- DC/IP: Galvanic Direct Current Resistivity/Induced Polarization.
- MT: Tensor Magnetotelluric Resistivity.
- P-DP: DC/IP pole-dipole acquisition configuration.
- Tx/Rx: DC/IP current injection/ receiver electrode.
- Ex/ Ey: MT in-line/cross-line station or electrode.
- Hx/Hy: MT inline/cross-line magnetometer.
- 1D: One dimensional inversion models.
- 2D: Two dimensional inversion models.
- DCInv2D<sup>TM</sup>/IPInv2D<sup>TM</sup>: UBC DC/IP inversion codes.
- UBC: University of British Columbia, Canada.
- RLM: Rodi, W., and Mackie MT Inversion Code.
- PW: Phil Wannamaker MT Inversion Code.
- Phs: MT Phase.
- Rho: MT Resistivity.
- TE (XY): Transverse Electric field (parallel to geology or strike direction).
- TM (YX): Transverse Magnetic field (perpendicular to geological strike or dip direction).
- Geotools<sup>TM</sup>: MT data processing and model-inversion platform.
- EDI: Electronic Data Interchange data.
- T# (e.g. T1): Interpreted DC/IP and MT Titan anomalous zone.
- MT- # (e.g. MT-1): Interpreted deep MT conductive zone.
- L#N (e.g. L1N): Titan survey line.
- DD- # (e.g. DDH-1): Recommended drillhole.
- Hz: Hertz.
- smDC: Smooth Direct Current Resistivity Sections.
- smIP: Smooth Induced Polarization Chargeability Sections.
- nullcon: UBC Inversion Models Using the Half Space Conductivity as Starting Reference Model.
- P.Geo.: Practicing Professional Geoscientist registered in a Canadian Association.
- QGL: Quantec Geoscience Limited.

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## APPENDIX A - STATEMENT OF QUALIFICATIONS

### EVELIO MARTINEZ DEL PINO

I, Evelio Martinez, declare that:

1. I am a Geophysicist with residence in Hamilton, Ontario and am presently employed in this capacity with Quantec Geoscience Ltd., Toronto, Ontario.
2. I obtained a Bachelor's Degree in Geophysical Engineering at ISPJAE University in La Habana, CUBA, in 1993, and a Masters Degree in Applied Geophysics (M.Sc.) at the ITC in Delft, The Netherlands, in 2000.
3. I am a registered geoscientist, since 2004, with license to practice in the Province of Ontario, (APGO License # 1058).
4. I am a member of the American Geophysical Union (AGU).
5. I am a member of Canadian Exploration Geophysicists Society (KEGS).
6. I have practiced my profession continuously since September 1993, in Cuba, The Netherlands, Portugal, Canada, Africa and Russia.
7. I have no interest, nor do I expect to receive any interest in the properties or securities of Ketz River Holdings Ltd., its subsidiaries or its joint-venture partners.
8. I am the Professional Geophysicist responsible for this project. I authored this Geophysical Interpretation Report and executed the data interpretation. I have compiled the final processed data, inversions and interpretation results, and I can attest that the information and inversions accurately and faithfully reflect the data acquired on site.
9. The statements made in this report represent my professional opinion based on my consideration of the information available.

*[signed and sealed]*

Evelio Martinez del Pino, M.Sc., P. Geo (ON)  
Senior Geophysicist.  
Interpretation Group  
Quantec Geoscience Ltd.

Toronto, Ontario  
November, 2009

**KEVIN J. KILLIN**

I, Kevin J. Killin, declare that:

1. I am a consultant with residence in Whitby, Ontario and am presently employed in this capacity with Quantec Geoscience Ltd., Toronto, Ontario.
2. I obtained an Honours Bachelor of Science Degree (HBSc), in Geological Geophysics from the University of Western Ontario in London Ontario, in 1986, including a Geology degree and Geophysics degree.
3. I have worked continuously since December, 1986, in North-America, Europe, South-America, The Middle East and Asia in the exploration industry.
4. I am a member of the Prospectors and Developers Association of Canada, and the Canadian Exploration Geophysics Society (KEGS).
5. I have no interest, nor do I expect to receive any interest in the properties or securities of Ketz River Holdings Ltd., its subsidiaries or its joint-venture partners.
6. I have been the Project Manager responsible for this project. I have reviewed the survey results, oversaw the preparation and reviewed this interpretation report. I can attest that these accurately and faithfully reflect the data acquired on site.
7. The statements made in this report represent my opinion in consideration of the information available to me at the time of writing this report.



*[signed]*

Kevin Killin, HBSc  
Project Manager  
Interpretation Group  
Quantec Geoscience Ltd.

Toronto, Ontario  
November, 2009

## APPENDIX B: PRODUCTION SUMMARY

DATE	FIELD ACTIVITIES AND OBSERVATIONS	PROCESSOR COMMENTS AND OBSERVATIONS	LINE	LINE START	LINE END	TX START	TX END	READ (km)			
								MT	IP	IP CURRENT EXTENSIONS	
<b>Ketz Project CA00681T- Production Summary</b>											
9-Jul-09	Mob from Whitehorse to Ketz Mine camp	Mob from Whitehorse to Ketz Mine camp									
10-Aug-09	Setup infinite, GPS & picket part of line, do PST & setup remote	Setup infinite, GPS & picket part of line, do PST & setup remote									
11-Aug-09	Finish GPS & picketting first line & part of 2nd line; setup line, and waited for batteries from the truck that broke down in Whitehorse	Finish GPS & picketting first line & part of 2nd line; setup line, and waited for batteries from the truck that broke down in Whitehorse									
12-Aug-09	Read IP & MT	Read IP & MT	L0N	0E	2400E	650W	3050E	2.4	0.1	0.7	
13-Aug-09	Read IP	Read IP	L0N	0E	2400E	650W	3050E		2.3	0.6	
14-Aug-09	Move to L600N, Start IP and MT	Read 7 Tx's for IP, Start MT	L600N	0E	2400E	650W	3050E		0.2	0.3	
15-Aug-09	Continue reading IP and MT	More LF MT events needed due to noisy results from the previous night	L600N	0E	2400E	650W	3050E	2.4	2.2	1.0	
16-Aug-09	Pick up L600N and start GPS & picket of L400N	Pick up L600N and start GPS & picket of L400N									
17-Aug-09	Start Setup of L400N. Not finished due to dangerous conditions & falling rocks.	Start setup of L400N.									
18-Aug-09	Start reading IP and read MT	Start reading IP and read MT	L400N	0E	2400E	650W	3050W	2.4	0.4	0.3	
19-Aug-09	Finish IP, picket L200N	Finish IP, picket L200N	L400N	0E	2400E	650W	3050W		2.0	1.0	
20-Aug-09	L200N deemed too dangerous, pick up gear from the field and pack up trucks	L200N deemed too dangerous, pick up gear from the field and pack up trucks									
21-Aug-09	De-mob to Whitehorse	De-mob to Whitehorse									
	<b>TOTAL SURVEY COVERAGE (KM) AND</b>								<b>7.2</b>	<b>7.2</b>	<b>3.9</b>

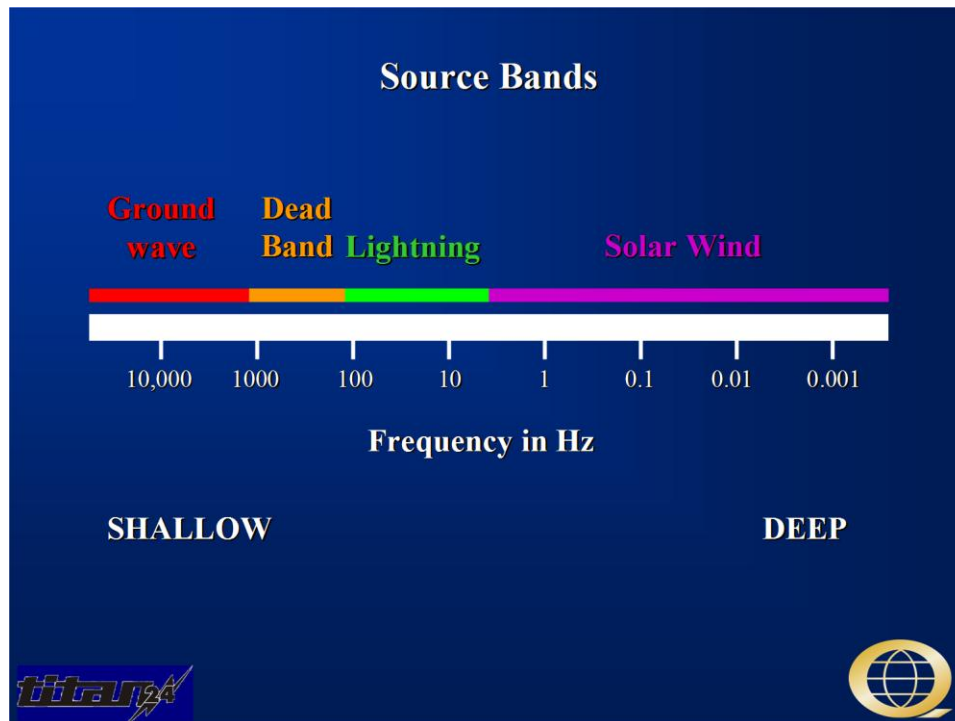
## APPENDIX C - MAGNETOTELLURIC (MT) THEORY

The magnetotelluric (MT) method measures time-variations in the Earth's natural electric (E) and magnetic (H) fields to image the subsurface resistivity structure. No source or transmitter is used. These natural fields penetrate much deeper than is practical with a transmitter. At the same time the natural signals are a plane-wave source. The plane-wave source is much simpler to model than complex transmitter geometries and signals.

The E and H fields are measured over a broad range of frequencies. Typically, the frequencies can range from above 10 kHz to below 0.001Hz. High frequency signals are attenuated more rapidly in the subsurface. High frequency data are indicative of shallow resistivity structure while low frequency data are indicative of deep resistivity structure.

At frequencies below 1Hz the signal source is due to oscillations of the Earth's ionosphere as it interacts with the solar wind. At frequencies above 1Hz the signal source is due to worldwide lightning activity. There is a lack of signal around 1Hz, often referred to as the "hole". Modern 24-bit recording hardware and signal processing techniques have largely eliminated the data quality problems that have been traditionally seen around the 1Hz signal hole.

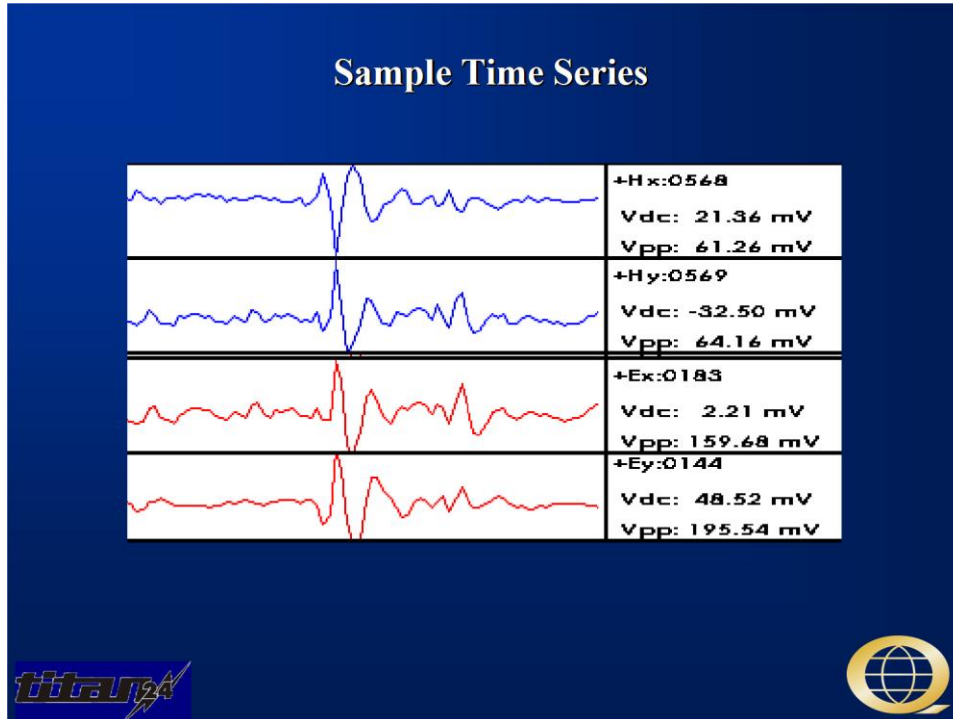
Between about 8Hz and 300Hz the signal from worldwide lightning activity propagates in a "resonant" cavity (the resistive atmosphere) between the conductive ionosphere and the Earth's surface. Above 3 kHz the signal propagates as a ground wave. Between 300Hz and 3 kHz there is a "dead-band" where the signal does not propagate well. Despite hardware and signal processing improvements this dead-band remains problematic. When signal (atmospheric activity) is present within several hundreds of miles of the survey area the data is quite good. When no signal is being generated in the vicinity data quality is poor.



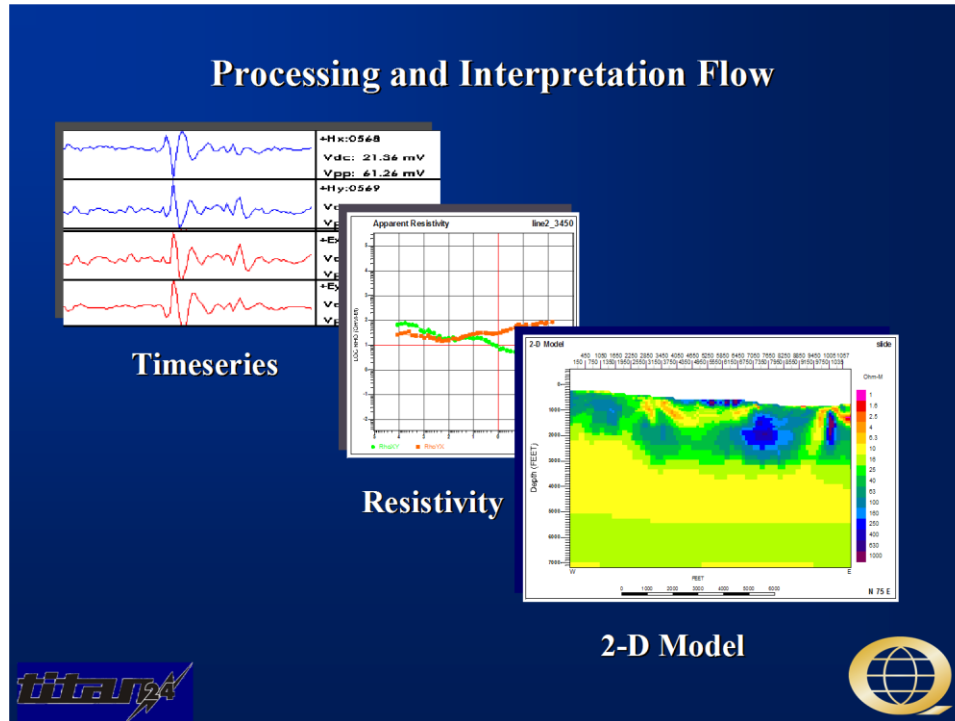
Both the electric and magnetic fields are measured. The measured fields depend on the ionosphere and lightning, and are essentially random. While the E and H fields are random the ratio of the fields depends on the subsurface resistivity structure. Note that it is primarily the orthogonal E and H fields that are related. The magnetic field must be measured perpendicular to the electric field. It is possible for complex subsurface resistivity structure to rotate the fields, and full tensor data are usually measured.

It is often useful to think of the magnetic field as the source signal and the electric field as the response. Time variations in the magnetic field induce currents to flow in the ground.

In the field the electric and magnetic fields are measured as a function of time. The electric field is measured using two orthogonal dipoles consisting of a wire connecting two grounded electrodes. In essence, the recording system consists of a voltmeter between the electrodes. The voltage measured depends on the electric field strength and the length of the dipole. The magnetic field is measured using an induction coil.



While the actual fields that are measured vary randomly (with solar and lightning activity), the relationship between the measured magnetic and electric fields is constant and depends on the subsurface resistivity structure. Extracting the subsurface resistivity structure from the measured magnetic and electric fields is a multi-step process. First time series processing techniques are used to derive geophysical parameters from the electric and magnetic fields. Then geophysical processing and inversion techniques are used to convert the geophysical parameters to a subsurface resistivity image. Finally, the resistivity image must be interpreted in terms of geologic units.



The measured magnetic and electric fields are Fourier transformed into the frequency domain. The system response is removed from the data (making the measurement independent of the hardware system). The Fourier coefficients represent the amplitude and phase of the electric and magnetic fields as a function of frequency.

A variety of signal processing techniques are used to minimize noise and bias in the estimation of geophysical parameters from the measured fields. The details are complex, but the approach is easily understood. Philosophically, the idea is to use multiple approaches to noise and bias reduction, not letting any one statistical approach have too much impact on the data, but relying on the combination of approaches to produce good estimates. The approaches include:

1. Spatial isolation of noise. A remote reference magnetic station is used to separate widely distributed signal from local noise.
2. Coherency sieves to find coherent signal. First the local and remote magnetic field measurements are compared and coherent signal kept. Then the local magnetic and electric fields are compared for coherency.
3. Frequency isolation of noise. Long Fourier transforms are used to provide extremely sharp isolation of noise in frequency.
4. Time isolation of noise. Short Fourier transforms are used to remove noise that is isolated in time (noise spikes, or noise that is randomly turning off and on).
5. Robust statistics that minimize biasing effects of a few isolated measurements.

Once the time series processing is complete geophysical parameters can be estimated. The primary geophysical parameters for MT are typically the apparent resistivity versus frequency and phase versus frequency.

The depth of penetration of the signal depends on its frequency and the resistivity of the rocks. The depth at which the signal amplitude has been attenuated to 37% (1/e) is called the skin depth and is defined:

$$\delta = \sqrt{\frac{2}{\mu\omega\sigma}} = 503 \left( \sqrt{\frac{\rho}{f}} \right) (m)$$

where

$\delta$  = skin depth

$\mu$  = magnetic permeability

$\sigma$  = conductivity=1/resistivity

$\omega$  = angular frequency=2 $\pi$ f

$\rho$ =resistivity=1/conductivity

The ratio between the two measured components (E and H) is the electrical impedance. The impedance (denoted Z) is defined as  $|Z| = |E/H|$ . The impedance is a complex number because the E and H fields are out of phase. Note that Z, E, and H are all functions of frequency.

The complex impedance is used to calculate an apparent resistivity as follows:

$$\rho_a = \frac{1}{\mu\omega} |Z|^2 (ohm.m)$$

The apparent resistivity is also a function of frequency. At any frequency the fields must travel through the overlying geology. The apparent resistivity depends on the integrated (weighted) conductance of the rocks being sampled. It is a smoothly varying function of frequency because it represents the average resistivity of a progressively larger volume of the subsurface. On a log resistivity-log frequency plot the apparent resistivity generally can not exceed a slope of +/- 45 degrees.

The phrase “apparent resistivity” arises from the volume averaging. At a single frequency the electric and magnetic fields measurements can be used to calculate an impedance. This impedance depends on the resistivity of a large volume of the subsurface. The impedance can be thought of as the impedance of a half-space that would provide identical measurements to the actual subsurface.

The calculated phase or apparent phase is the difference between the measured E field phase and the measured H field phase. If the subsurface is one-dimensional (1D) or two-dimensional (2D) the phase is related to the resistivity. The Hilbert formula (minimum phase wavelet) relates the phase to the slope of the apparent resistivity curve. If the slope of the resistivity curve (on a log-log plot) is 0 the phase is 45 degrees. If the resistivity is increasing with decreasing frequency the phase is less than 45 degrees. If the resistivity is decreasing with decreasing frequency the phase is more than 45 degrees. As the apparent resistivities are constrained to a slope of no more than 45 degrees on a log-log plot, the phases are constrained to remain in a quadrant, between 0 and 90 degrees.

The phase measurement is largely independent of the apparent resistivity measurement. The Hilbert relationship provides an independent way to calculate the apparent resistivity curve from the phase data. There are effectively two independent measurements of the resistivity curve, providing a powerful check on data quality.

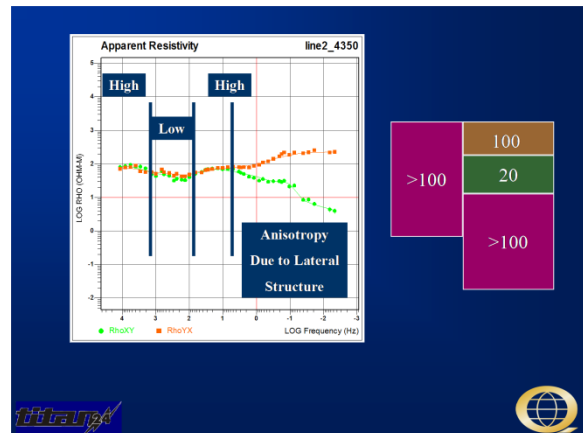
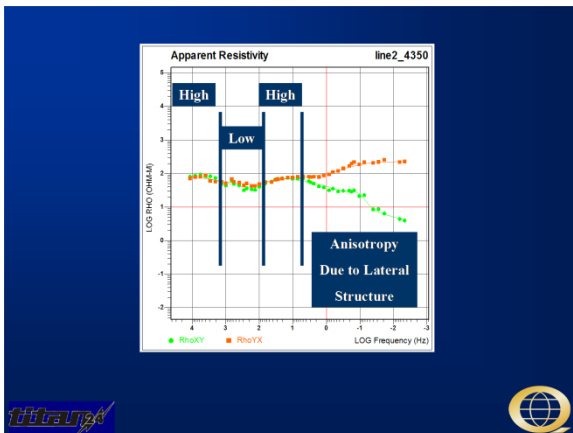
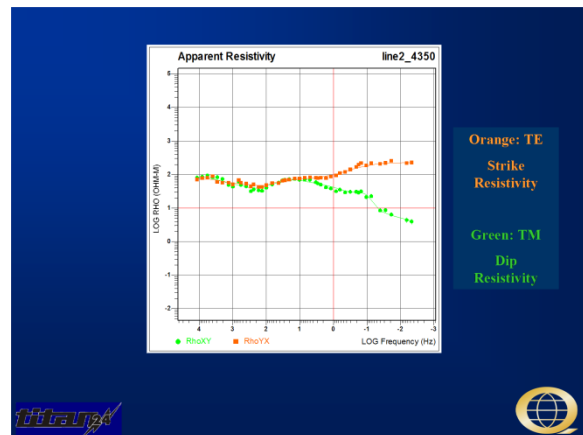
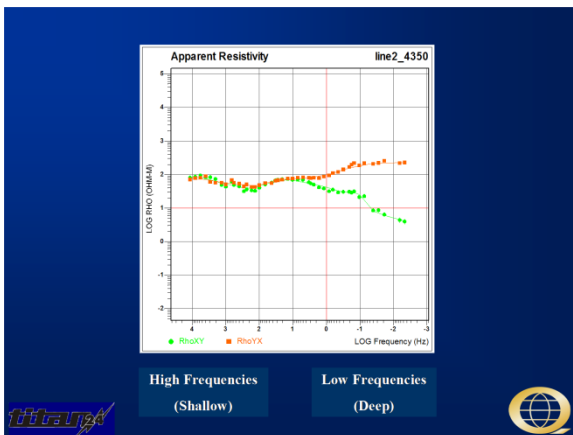
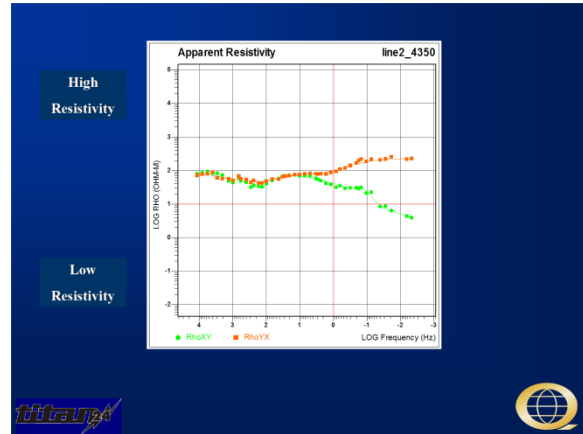
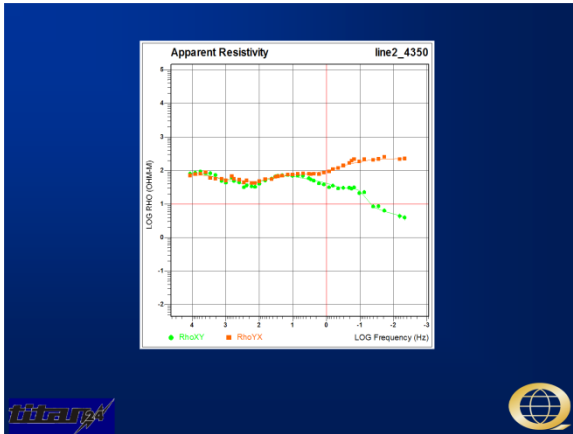
The apparent resistivity and phase curves are the primary parameters used in the interpretation of MT data. For a layered (1D) earth the apparent resistivity and phase data can be converted into intrinsic resistivity versus depth simply by accounting for the volume averaging nature of the method. There are a variety of algorithms for doing the conversion. The conversion is not unique. Some algorithms provide smoothly varying intrinsic resistivity versus depth functions (Occam inversion, Bostick transform). Others provide distinct layered solutions (Marquardt inversion).

1D modeling and inversion raises the following points:

- A single MT site provides information about resistivity versus depth. This is a major distinction from potential fields techniques that only provide information about relative variations along a profile.
- The conversion from apparent resistivity versus frequency to intrinsic resistivity versus depth is not unique. It is susceptible to equivalence. In particular any sharp resistivity contrast can be replaced by an equivalent transition zone.
- In a layered model the thickness of a resistive layer is well resolved. The resistivity of a resistive layer is poorly resolved.
- In a layered model the conductance (conductivity\*thickness) of a layer is resolved. Neither the thickness nor the conductivity is uniquely resolved.
- Once the constraint that the subsurface is composed of distinct, resolvable, units is imposed the 1D inversion of MT data is essentially unique. Resolution is excellent (better than 5% of depth).

Apparent resistivity versus frequency is the most fundamental way of looking at the data in the interpretation phase. While the overall process is complex, with advanced processing techniques and inversions, it is important to keep in mind that the subsurface structures are apparent in the raw data – the apparent resistivity plots.

The following sequence of illustrations is intended to introduce the apparent resistivity versus frequency sounding curves. But it is also intended to highlight the relatively complex, but understandable, relationships between the observed data and subsurface structure.



A simple layered subsurface structure is not generally the problem of immediate interest in exploration. In the case of more complex two-dimensional (2D) or three-dimensional (3D) structure the MT response will be affected by lateral resistivity variations.

The MT measurement relies on natural, plane-wave, source signals. The measured response depends on lateral resistivity variations as much as (or more than) resistivity variations below the immediate sounding site.

Full tensor measurements of the E and H fields are made at every site. For each site there are two apparent resistivity sounding curves (or modes) and phase curves. These two modes are arbitrarily labeled Rho-XY and Rho-YX. The first, Rho-XY, refers to the apparent resistivity (Rho) calculated from  $E_x$  and  $H_y$ .

Once full tensor measurements are made in the field it is possible to mathematically rotate the fields to any arbitrary coordinate system. Traditionally, the data are rotated independently at each frequency to maximize the difference between the two apparent resistivity sounding curves. This puts the data into “geologic” or “principal” coordinates.

One sounding curve will have the electric field in the geologic strike direction and is referred to as “Transverse Electric” or TE. The other mode will have the electric field in the geologic dip direction and is referred to as “Transverse Magnetic” or TM. Note that TE and TM are interpretive designations, and refer to geologic strike. XY and YX were simply geometric designation.

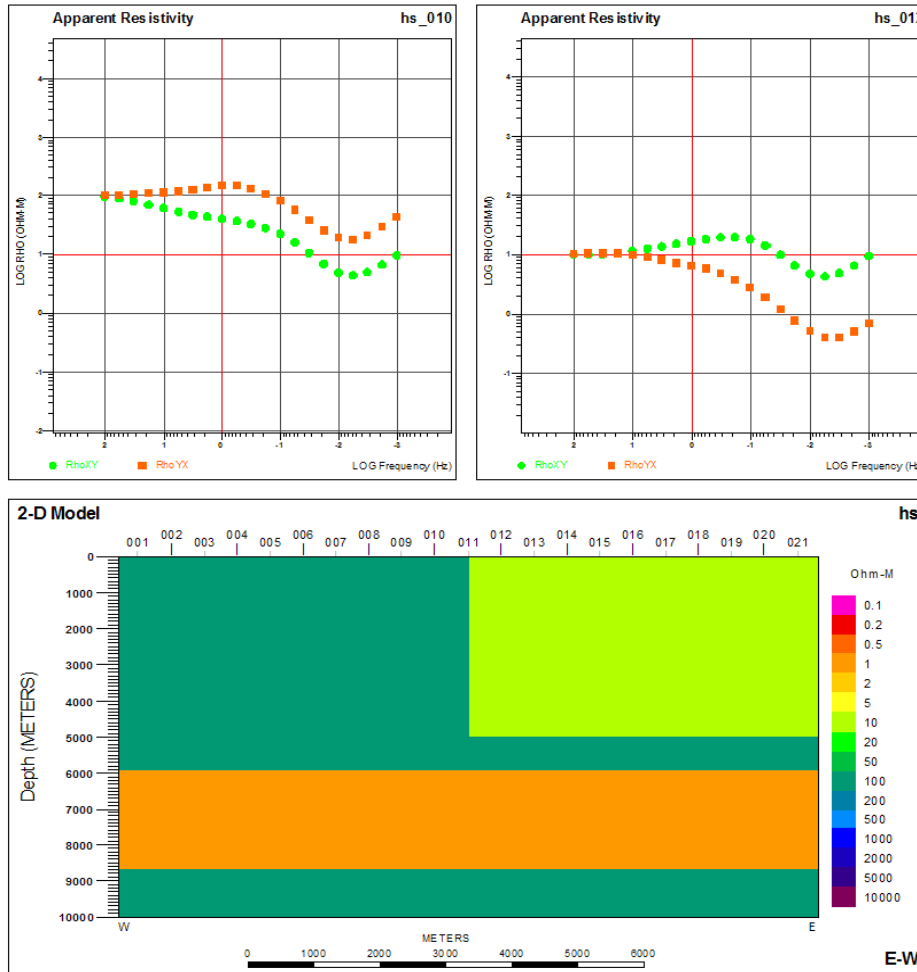
For a layered (1D) earth the two measurements are identical. When the structure is 2D or 3D the lateral resistivity variations will distort (often severely) the simple 1D response. The distortion of the fields by complex structure is realized in the apparent resistivity data as “anisotropy”. This is a divergence between the two apparent resistivity sounding curves.

The measurement of two orthogonal apparent resistivity sounding curves provides valuable information. Both curves reflect the resistivity structure underlying the site. Both curves will show increasing or decreasing resistivity at a frequency in response to resistivity structure under a site. The two apparent resistivity curves will diverge in response to lateral resistivity variations.

If the site is located on the resistive side of a lateral resistivity contrast the TE mode will be slightly suppressed due to the contact and the TM mode will be significantly biased up by the contact. If the site is located on the conductive side of a lateral resistivity contrast the TE mode will be slightly biased up while the TM mode will be significantly biased down by the contact.

For a 2D resistivity structure the TE mode is always providing an indication of the integrated conductance of the volume being sampled. It will always be a slowly varying function of position. The TM mode is responding dramatically to the presence of changes on the lateral resistivity boundaries, and will dramatically overshoot on the resistive side of a contact and undershoot on the conductive side. The anisotropy (divergence of the two sounding curves) is diagnostic of a lateral resistivity contrast.

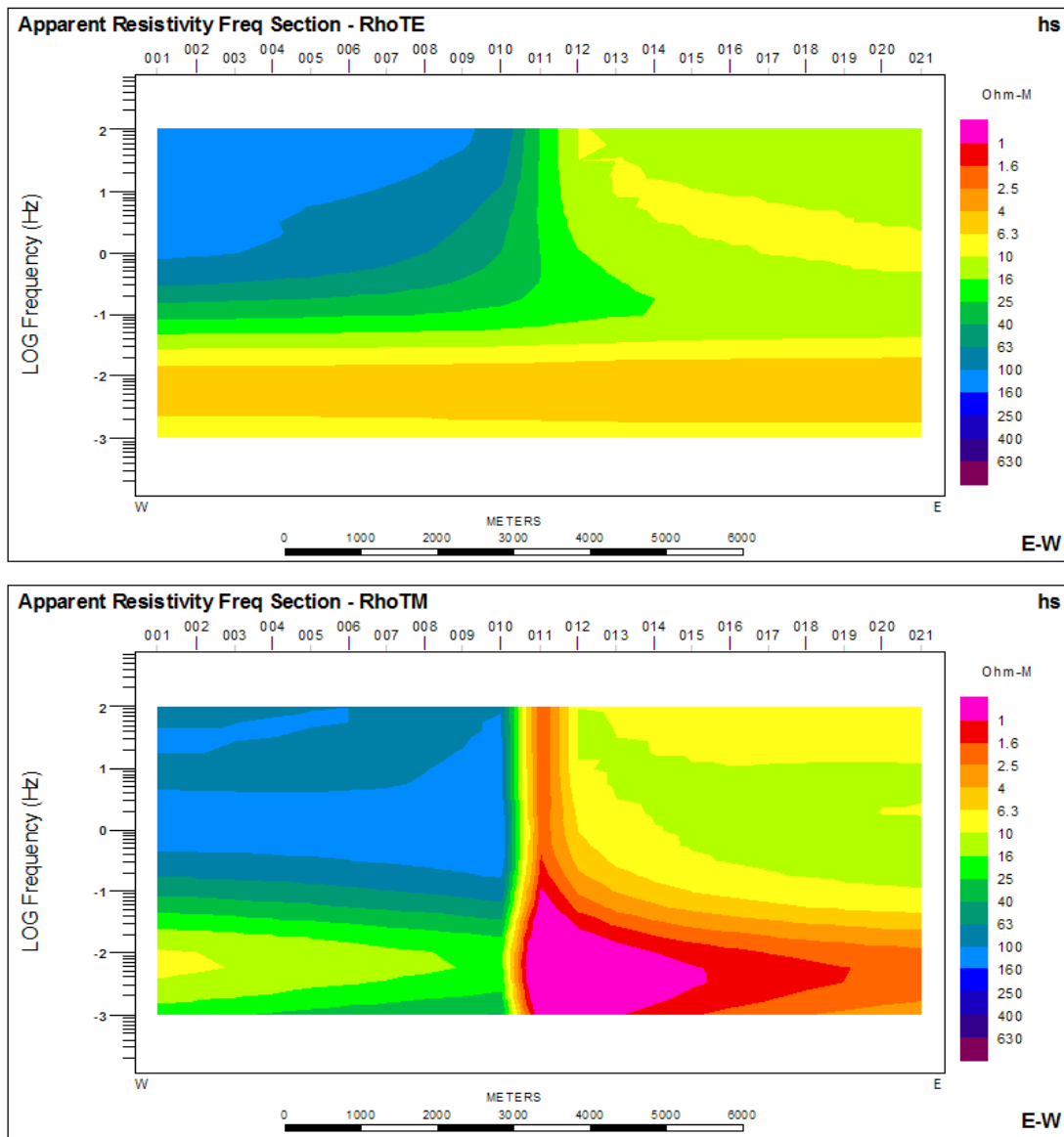
The following simple model demonstrates most of the critical 2D behaviours. The model consists of a 100 Ohm-m host with a 10 Ohm-m basin on the right. There is a 1 Ohm-m layer buried within the host and below the basin. The response is shown at two sites, one immediately on the resistive side of the basin contact and the other immediately on the conductive side of the contact.



The following observations summarize the behaviour of 2D MT responses:

- The apparent resistivity at high frequencies reflects the true shallow resistivity.
- The apparent resistivities converge at high frequencies to the true shallow resistivity.
- The divergence in apparent resistivities occurs at a higher frequency for the site on the resistive side of the contact. Because the skin depth is larger in the resistive media the site on the resistive side of the contact is effectively “closer” to the contact than the site on the conductive side of the contact. The TE mode is constrained to the range of physical resistivities actually present in the model
- The TE mode “volume averages” the intrinsic resistivity. The TM mode exhibits apparent resistivities outside the range of physical resistivities in the model. Note that for the site on the right the TM mode indicates resistivities below 1 Ohm-m.
- Both the TE and TM modes respond in tandem, at the same frequency, to resistivity structure under the site. At both sites both the TE and TM modes indicate the top and bottom of the 1 Ohm-m layer. While 1D inversion of the TE and TM modes would place different apparent depths to the 1 Ohm-m layer the response is at the same frequency in both modes indicating it is the response of one layer.
- The intrinsic resistivity of the 1 Ohm-m layer is difficult or impossible to discern. Without physical property data only the conductance of the layer can be resolved.

These effects can also be clearly seen in pseudo-sections of the TE and TM apparent resistivity response of the model:



The apparent resistivity data at each site have been contoured, as a function of frequency. The inherent smoothness of the TE section can be clearly discerned. The distinctive “undershoot” of the TM response on the conductive side of the contact can be clearly seen.

One of the key factors in multidimensional MT data is “static shifts”. The apparent resistivity sounding curves can be biased, up or down, by lateral resistivity contrasts too small to be resolved by the MT data. The curve is essentially DC shifted on the log-log apparent resistivity plot. This can be seen by examining the sounding curves from the previous 2D model. Assuming data had not been acquired above 1Hz the two sounding modes would be seen to be separated in the highest frequency data. Note that there are no static shift effects in the phase data.

Inversions and forward modeling are used to derive the subsurface resistivity structure from the data. The primary interpretation tools are 2D inversions. Problems emerge when the real world, complex, data are not consistent with the simplistic 2D assumptions. In a perfect world we would use modeling and inversion programs capable of reflecting the full complexity of the subsurface. However, in practice incorporating too much complexity in the modeling and inversion programs results in very coarse models which are incapable of resolving exploration targets. Instead, we must find ways to remove some of the complexity from the actual data. To this end, we have developed the Titan “EVA” data processing stream:

- Rotation to principal coordinates. The inversion algorithms presume that we have acquired a true geologic dip profile. In reality, geologic dip is often difficult to define, and seldom known prior to acquisition. However, because we have acquired full tensor data we can rotate our data to the geologic dip direction after acquisition.
- Eigenvector processing. 3D structures can introduce complex “rotations” of the electrical currents. These rotations produce effects, such as excessively steep resistivity curves and out-of-range phases, which would be impossible to fit with 2D modeling programs. By relaxing the assumption that the electric and magnetic fields are orthogonal, eigenvector analysis provides a unique and trivial methodology for simplifying complex 3D data.
- 1D inversion for curve fitting. Real data are often noisy, and inconsistent. Out-of-range phases are a typical example of features seen in real data that can not be fit using 2D inversion. It is often best to make use 1D inversion to make interpretative decisions about how to “best” fit the data, rather than letting the 2D inversion thrash trying to fit inconsistent data.

Once these data processing techniques have been completed the data are inverted. Generally, two inversions of the MT data are done. The first inversion uses an approach (a model norm) that explicitly looks for the “smoothest” model consistent with the data. This approach essentially finds the minimal subsurface structure consistent with the data. The second inversion uses an approach (a model norm) that looks for a model most consistent with the known geology.

For the geologically constrained inversion we use a proprietary approach developed by Dr. Phil Wannamaker. This approach uses the geologic constraints as a target, while not imposing any intrinsic smoothing on the inversion. The approach finds the maximum structural information, at the risk of sometimes including structure not required by the data. It represents an effort to extract the maximum exploration information from the data.

Both approaches are valid, and important. A smooth model approach to inversion can be viewed as finding the least possible useful exploration information. However, it does provide an independent assessment of what the data actually require. The geologically constrained inversion will provide a much sharper subsurface image. But it will also reproduce the known geology where the data does not require a change to the model. Without an independent smooth model inversion it can be hard to determine whether a geologically constrained inversion has confirmed the geologic interpretation, or simply doesn’t have any information either way.

## APPENDIX D – DIRECT CURRENT RESISTIVITY AND INDUCED POLARIZATION (DCIP) THEORY

### INTRODUCTION

The resistivity is among the most variable of all geophysical parameters, with a range exceeding  $10^6$ . Because most minerals are fundamentally insulators, with the exception of massive accumulations of metallic and submetallic ores (electronic conductors) which are rare occurrences, the resistivity of rocks depends primarily on their porosity, permeability and particularly the salinity of fluids contained (ionic conduction), according to Archie's Law. In contrast, the chargeability responds to the presence of polarizable minerals (metals, submetallic sulphides and oxides, and graphite), in amounts as minute as parts per hundred. Both the quantity of individual chargeable grains present, and their distribution within subsurface current flow paths are significant in controlling the level of response. The relationship of chargeability to metallic content is straightforward, while the influence of mineral distribution can be understood in geologic terms by considering two similar, hypothetical volumes of rock in which fractures constitute the primary current flow paths. In one, sulphides occur predominantly along fracture surfaces. In the second, the same volume percent of sulphides are disseminated throughout the rock. The second example will, in general, have significantly lower intrinsic chargeability.

More detailed descriptions on the theory and application of the IP/Resistivity method can be found in Van Blaricom (1992) and Telford et al. (1976).

### HALVERSON-WAIT CHARGEABILITY

The Titan-24 DCIP chargeability decays are described using the Halverson-Wait spectral model (Halverson et al., 1981), which is not well known, but is similar to the Cole-Cole model proposed by Pelton et al. (1978) which is a simple relaxation model that fits complex (frequency-dependant) resistivity results.

The time domain chargeability, originally proposed by Siegel (1959), is defined (Telford et al., 1976) as:

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

Where  $V(t)$  is the residual or secondary voltage at a time  $t$ , that is decaying after the current is cut off, between time  $t_1$  and  $t_2$ , with the steady voltage  $V_c$  during the current flow interval. The ratio  $V(t)/V_c$  is expressed in millivolts per volt.

In the frequency domain, the "frequency effect" is defined as:

$$fe = (\rho_{DC} - \rho_{AC}) / \rho_{AC}$$

Where  $\rho_{DC}$  and  $\rho_{AC}$  are apparent resistivities measured at d.c. and "very high" frequency, usually in the 0.1 to 10 Hz range. The Cole-Cole model for the chargeability  $m$ , as defined by Pelton et al. (1978) is given by the following:

$$Z(\omega) = R_0 \left[ 1 - m \left( 1 - \frac{1}{1 + (i\omega\tau)^c} \right) \right]$$

Where  $Z(\omega)$  is the complex impedance,  $R_0$  is the DC resistivity,  $m$  is the chargeability in volts per volt,  $\omega$  is the angular frequency in Hz,  $\tau$  is the time constant in seconds, and  $c$  is the frequency dependence (unitless). The latter two physical properties describe the shape of the decay curve in time domain or the phase spectrum in frequency domain, and commonly range between 0.01s to +100s and 0.1 to +0.5, respectively (Johnson, 1984).

The Halverson-Wait model was proposed by Halverson et al. (1981) as an extension to the Wait (1959) model of the impedance of “volume loading” of spheres, given by:

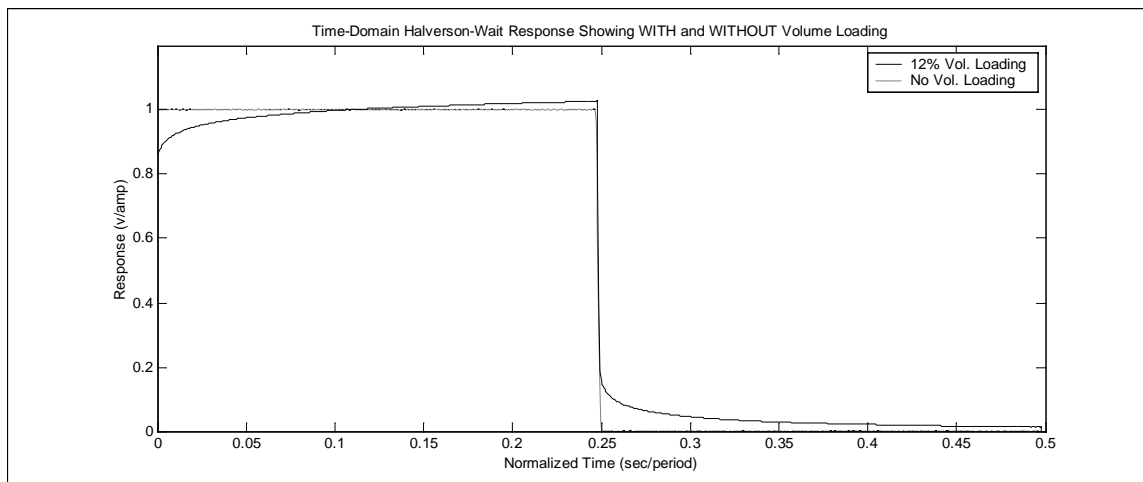
$$Z(\omega) = \frac{\rho}{G} \left[ 1 - 3v \left( 1 - \frac{3\delta}{1 + 2\delta} \right) \right]$$

Where  $G$  is a geometric factor,  $\rho$  is the resistivity of the media,  $v$  is the volume loading (the volume fraction of chargeable “spheres”),  $\delta$  is the sphere surface impedance. The Wait model was designed to provide an explanation of the differences in the shape of decay curves from different polarizable targets, but does not describe very well the physical attributes of the rocks.

The Halverson-Wait model expands the Wait coated sphere IP model to include a new formulation of the sulphide-rock interface impedance, based on field studies and laboratory tests on samples. It is closely correlated to the Pelton et al. (1978) Cole-Cole model and is given by:

$$Z(\omega) = \frac{\rho}{G} \left[ 1 - 3v \left( 1 - \frac{3/2}{1 + r[i\omega]^k} \right) \right]$$

Where  $r$  is the sphere radius and is equivalent to  $\tau$  - the Cole-Cole time constant ( $r = \tau^k$ ). The  $v$  volume loading compares well to  $m$  - the Cole-Cole chargeability (see equation below) – and the exponent  $k$  is equal to  $c$  - the Cole-Cole frequency dependence (Halverson et al., 1983). For sulphide systems, the  $r$ -factor reflects the size or interconnection of the sulphide grains and the  $k$ -factor reflects the electrical characteristics of the sulphide surfaces. An example of time domain Halverson-Wait model responses is shown in Figure J.1.



**Figure J.1: Polarizeable versus Non-Polarizeable TDIP Response using Halverson-Wait Model**

In practice the Titan chargeability decays are fit to a Halverson-Wait model. In order to solve for the volume loading  $\nu$ , the r-factor and k-factor are set to the standard (typical) Halverson-Wait values of 1.0 and 0.2, respectively. In the Halverson-Wait model the theoretical PFE (for infinite bandwidth), which equates to the theoretical chargeability in the Cole-Cole equation, is thereby defined by the volume loading:

$$PFE_0 = m_0 = \frac{9\nu}{(2 + 3\nu)}$$

and  $m$  is output in units of milliradians.

### INVERSION THEORY

An excellent overview and introduction to both the philosophy and use of inversions in geophysics is available on the University of British Columbia (UBC) website (<http://www.geop.ubc.ca/ubcgif/>; Oldenburg et al., 1998).

Several points, detailed on the website, are crucial to understanding the Titan-24 approach to exploration:

- Inversion is a powerful ‘tool’, not a ‘solution’.
- Inversion is not normally “unique”. Given noisy and incomplete data of inherently limited resolution there are usually an ‘infinite’ range of models that ‘fit’ the data equally well. Recognition of this inherent non-uniqueness is why inversion must be viewed as a tool rather than a solution. Understanding and exploration of this non-uniqueness is an important part of the interpretive process.
- Inversion finds a model that ‘fits’ the data. The precise definition of ‘fit’ can be critical in the actual model that is found.
- The inversion depends on the data, and the data errors. The importance of the data errors is often overlooked.
- Inversion depends on a “model norm” – the mathematical definition of which model the inversion should try to find. This definition is almost as important as the actual data in determining the final inversion model.

Mathematically, inversion is the process of minimizing a function. The choice of which function to minimize ultimately defines the inversion model. Schematically, this function might be expressed:

$$\phi = \phi_d + \beta \phi_m = (\text{misfit}) + \beta (\text{model norm})$$

$$0 < \beta < \infty \text{ is a constant}$$

This defines a function to be minimized that consists of some function that minimizes the data misfit, combined with some function that finds a “smooth” model. Beta represents a relative weighting between fitting the data and smoothing the model.

Clearly, the data misfit function must be defined in more detail. One approach might be:

$$\phi_d = \sum_{i=1}^N \left( \frac{F_i[m] - d_i^{obs}}{\epsilon_i} \right)^2$$

This function defines the data misfit as the sum of the individual misfits squared, normalized by the errors associated with each data point. It is a very common, and stable, definition of the data misfit.

An important point not made on the UBC website is that the errors depend on many factors. The most common measure of data errors is simply the repeatability of the voltage and current measurements in the field. This may be misleading as there are also “errors” associated with electrode positioning, geologic complexity (2D vs 3D, but also coupling of shallow and deeper structure), and errors in the numerical calculation of model responses and inversion.

Another point not sufficiently detailed on the UBC site is the importance of not overestimating the data errors and fitting the data as closely as possible. Most geophysical techniques, but particularly electrical techniques, have large responses to shallow structure. This is expressed as “pant legs” in DC/IP, or “statics” in MT. The response to deep structure is generally a very subtle component of the data, compared to the sensitivity to shallow structure. Without excellent data, and an excellent match between the data and model response, the deep structure will not be imaged to the degree necessary for commercial exploration.

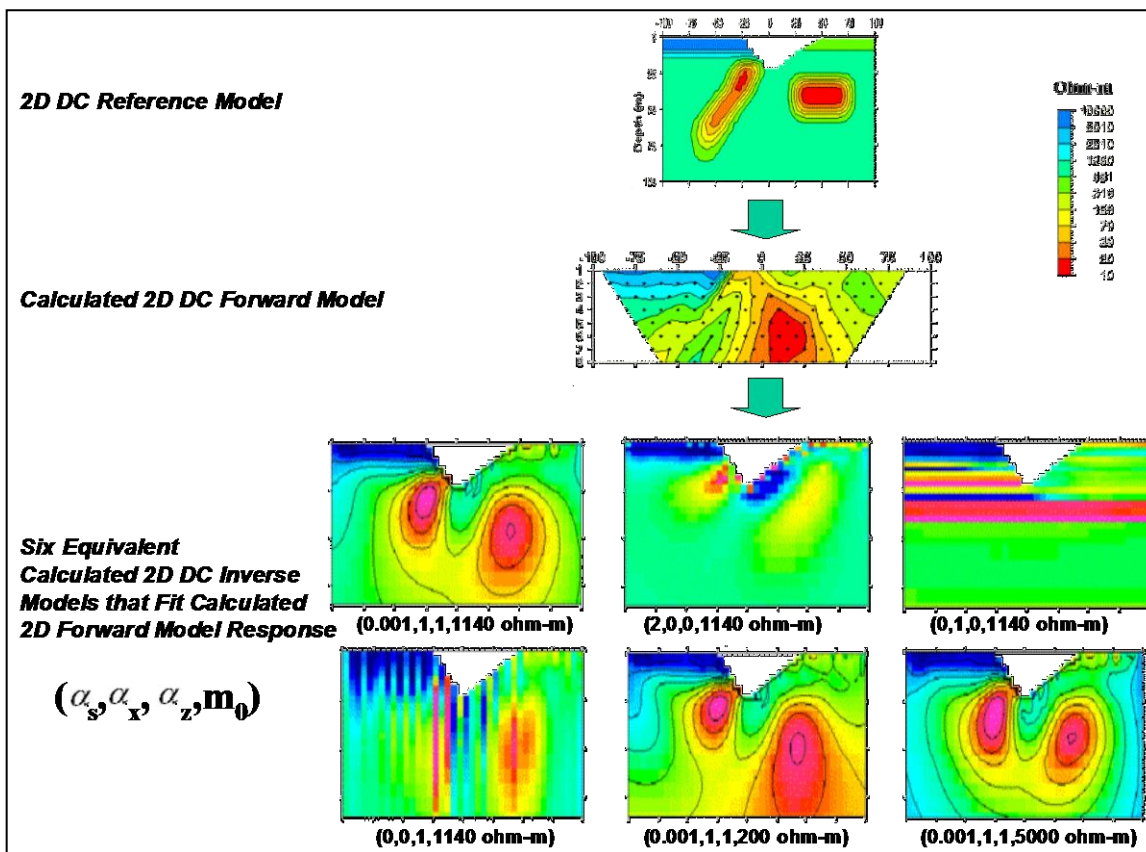
The model misfit function must also be defined in more detail. One of the most flexible definitions is the one used by UBC:

$$\phi_m(m, m_0) = \alpha_s \int_{vol} (m - m_0)^2 dv + \alpha_x \int_{vol} \left( \frac{\partial(m - m_0)}{\partial x} \right)^2 dv + \alpha_z \int_{vol} \left( \frac{\partial(m - m_0)}{\partial z} \right)^2 dv$$

In this definition there are three components to the “model norm” (or “smoothness” constraint, or “regularization”), each of which contains an  $\alpha$  constant ( $\alpha_s, \alpha_x, \alpha_z$ ) that are commonly referred to as “alpha parameters”. The first component is simply an overall difference between the model and a “target” model, the second component is a horizontal smoothness, and the third component is a vertical smoothness. The three “alpha” parameters ( $\alpha_s, \alpha_x, \alpha_z$ ) represent a relative weighting of each component. A fourth variable,  $m_0$ , refers to the starting or reference model – either a half-space or geophysical constraint – that also has a profound influence on the model-misfit.

The UBC website provides an excellent example of the importance of selecting an appropriate “model norm”, reproduced in Figure J.2

In this example the expected response of the top figure was computed. These ‘data’ were then inverted six times, using different “model norms” ( $\alpha_s, \alpha_x, \alpha_z, m_0$ ). The lower six figures show the range of valid inversion models that can be produced. Note that six of these models are essentially mathematically equivalent, they all “fit” the data.



**Figure J.2: Effects of Model Norm and Starting Model on Inversion Results (modified after Oldenburg, et al., 1998).**

An important philosophy, driving much of the academic communities approach to inversion for the last two decades, is that the “best” model is the “smoothest” model consistent with the data. There are good reasons for taking this approach. However, from an exploration viewpoint this philosophy can be rephrased to “find the model with the least exploration value” – perhaps not reflecting the real goal of an exploration program.

Recently, several groups have taken major steps towards developing inversion approaches more tuned to exploration needs. Instead of using “smooth” model norms, they are being replaced with “focused (minimum transition zone) inversion, or smoothing to a geologic “target” model.

For exploration smoothing to a geologic target model makes sense. It requires good geologic control, and some understanding of the rock physical properties. There are three drawbacks to the geologic target approach:

- The geologic information is incomplete or inaccurate.
- Physical property data are incomplete.
- It is difficult to determine whether the geophysical data support the geologic model, or simply provide no information.

The most sensible approach is to combine smooth model inversion with geologic target inversion. For now, we are focusing on providing inversions using both approaches. It is up to the project geologist and geophysicist to review these inversions and develop a final interpretation.

## APPENDIX E: TITAN INVERSION RESULTS

This appendix contains a description on the TITAN DC/IP and MT data processing and inversion, as well as an outline on the inversion results for each individual model, including Quality Control and Assurance (QC/QA) comments.

### GLOSSARY OF TERMS

SMDC: SMOOTH DIRECT CURRENT RESISTIVITY SECTIONS

SMIP: SMOOTH INDUCED POLARIZATION CHARGEABILITY SECTIONS

NULLCON: UBC INVERSION MODELS USING THE HALF SPACE CONDUCTIVITY AS STARTING REFERENCE MODEL

MT: MAGNETOTELLURIC

RLM: RODI, W., AND MACKIE MT INVERSION CODE

LINE#\_PUM\_HRP\_IT#: CONJUGATE PW INVERSIONS DERIVED FROM INVERTING THE 1D FITTED AND INTERPOLATED DATA, WITH NO ROTATION OF THE PRINCIPAL COMPONENTS. THESE MODELS USED THE HALF SPACE RESISTIVITY (250 OHM-METERS) AS STARTING MODELS, AND WERE CONSTRUCTED USING TM (PHASE + RESISTIVITY) AND TE (PHASE + RESISTIVITY) DATA.

LINE#\_PUM\_HTM\_IT#: CONJUGATE PW INVERSIONS DERIVED FROM INVERTING THE 1D FITTED AND INTERPOLATED DATA, WITH NO ROTATION OF THE PRINCIPAL COMPONENTS. THESE MODELS USED THE HALF SPACE RESISTIVITY (250 OHM-METERS) AS STARTING MODELS, AND WERE CONSTRUCTED USING TM (PHASE + RESISTIVITY) DATA.

PW: PHIL WANNAMAKER MT INVERSION CODE

IT#: ITERATION NUMBER

#### DCIP DATA PREPROCESSING:

For the inversions, the raw data were edited, including adjustment of data errors and removal of poor quality data allowing the program to reach appropriate model misfits and consistent inversion models. The editing and preprocessing of the datasets included:

1. Filtering the raw data<sup>1</sup> using the **DCIPSuper.exe** program with the following “Quantec<sup>2</sup>” input parameters:
  - All negative Vp values were excluded for the inversions
  - All apparent resistivity values <500 000 Ohm-meters were included
  - Small apparent resistivity values <0.001 Ohm-meters were excluded
  - All phase values <300 milliradians were included
  - All phase values >-50 milliradians were included
  - High Vp errors <20% were included
  - High phase errors <10% were included
  - Apparent resistivity limits: from 0.001 Ohm-meters to 500 000 Ohm-meters
  - Phase limits: from -50 milliradians to 300 milliradians
2. Exclusion of the data points (for both the voltage and phase) with Vp errors higher than 20%.
3. Exclusion of negative phase data points (>50 %)
4. Exclusion of data points with phase errors (>10%).
5. Starting Error floor of 0.5 milliradians added to the final phase data files for inversions.

#### 2D DCIP UNCONSTRAINED INVERSIONS:

In general, the quality of the DCIP raw data is good. Pre-processing of the DC Resistivity & Induced Polarization (DC/IP) data involved adjustment of data errors and removal of poor quality data. The DC Resistivity and IP unconstrained inversion models were calculated using the **UBC DCInv2D<sup>TM</sup> & IPInv2D<sup>TM</sup> 2D<sup>3</sup>** algorithm (Oldenburg & Li, 1994) and **IPView-IIC<sup>4</sup>** platform. Multiple unconstrained inversion models were produced in order to arrive at the final 2D inversion models. Smooth inversions were executed for both the DC resistivity and IP datasets. The Smooth DC and IP Inversion Models<sup>5</sup> were derived from setting the **chi<sup>6</sup>** factor to the programs default (NULL). The **as<sup>7</sup>**, **ax** and **ay<sup>8</sup>** parameters were set to the inversion code default (NULL).

<sup>1</sup> Raw data contained in the digital files “Line#.csv”.

<sup>2</sup> Quality Control Process passes all data thru except dipoles straddling current electrodes.

<sup>3</sup> UBC-Geophysical Inversion Facility (GIF): Department of Earth and Ocean Sciences at the University of British Columbia.

<sup>4</sup> IPView: Version 2.1.5 beta (Industrial imaging Co., Inc.); Written by B. Petrick and Licensed to Quantec Geoscience Ltd.

<sup>5</sup> The inversion models presented in this report are the most consistent models according to the degree of association with the DC and MT results and the available geological information. Additional inversion models are available in the Digital Archive attached to this Interpretation Report.

<sup>6</sup> The **chi** parameter controls the inversion misfit.

<sup>7</sup> The **as** parameter controls the degree of closeness between the constructed model and the initial model.

<sup>8</sup> The **ax** and **ay** parameters control the horizontal and vertical smoothness of the model respectively.

The data was further edited as necessary to achieve convergence with a final resulting misfit equal to or approximately equal to the number of data points input to the inversion code. No Sharp Inversion Models were produced or presented in this interpretation report.

The inversions were generally run with successive removal of poorly fitting data and error adjustment before arriving at the final 2D models. Some data acquired with large transmit-receiver separations were not of high quality and were removed prior to inversion.

One set of Smooth IP inversion models was derived assuming a homogenous half-space (conductivity distribution set to NULL). This IP model (apparent chargeability distribution) was useful for defining and/or improving the interpretation of the chargeability models when the resulting IP inversions were distorted by incorporating a DC model with high resistivity contrasts.

Three basic DC and IP inversion models were calculated as follow:

1. **L#N\_smDC**: Smooth DC “Resistivity” inversions from inverting the voltage data (contained in the raw *L#N.csv* file). The Smooth DC inversions were topographically corrected according to the Quantec inversion mesh (*L#N\_meshPLDP.txt*), and the elevation file (*L#N.topo*) from the GPS survey files.
2. **L#N\_smIP**: Smooth IP “Chargeability” inversions from inverting the phase data (contained in the raw *L#N.csv file*). The Smooth IP inversions used the Titan 2D conductivity model (derived from the Smooth DC “Resistivity” inversions), and were topographically corrected according to the Quantec inversion mesh (*L#N\_meshPLDP.txt*), and the elevation file (*L#N.topo*) from the GPS survey files.
3. **L#N\_smIP\_nullcon**: Smooth IP “nullcon Chargeability” inversions from inverting the phase data (contained in the raw *L#N.csv file*). The Smooth IP “nullcond” inversions used the half-space conductivity, and were topographically corrected according to the Quantec inversion mesh (*L#N\_meshPLDP.txt*), and the elevation file (*L#N.topo*) from the GPS survey files.

#### **MT DATA PREPROCESSING:**

The initial data input into the Geotools database were line-station data, taken directly from the EDI archive<sup>9</sup>. The raw impedance tensor data span the 0.1 Hertz to 10000 Hertz bandwidth, with a data density of approximately 6-8 points per decade. Data points with high noise levels were removed from the Apparent Resistivity and Phase curves prior to inversion. In some cases, low frequency data <1 Hertz was not included in the inversion due to low signal-to-noise levels. High frequency (>10000 Hertz) phase data, not consistent with the resistivity data, was also excluded.

#### **1D MT MODELS:**

One-dimensional (1D) inversions (*L#\_unr*<sup>10</sup>) were generated for the acquired lines. The TM and TE curves were fit to the raw data to ensure that the apparent resistivity and phase are smooth and consistent. The apparent resistivity and phase from the fit data are then interpolated to obtain 12 frequency responses per decade. Stitched 1D Determinant sections (*L#\_det*<sup>11</sup>) were also calculated to supply an alternative starting models for the 2D inversions. Phase curves or intervals with gradient exceeding 45 degrees where not included in the inversions. These intervals are inconsistent with the MT theory and are considered as no MT signal originated from local sources and/or noise.

<sup>9</sup> Data contained in the “Geophysical Survey Logistics Report” Digital Archive.

<sup>10</sup> 1D Unrotated Inversion Models.

<sup>11</sup> Stitched 1D Determinant Inversion Models.

## 2D MT UNCONSTRAINED INVERSIONS:

The MT inverse models were calculated using the Geotools™ MT processing and model-inversion platform. Two (2) sets of 2D PW models (pum\_hrp<sup>12</sup> and pum\_hm<sup>13</sup>) were derived from inverting the unrotated data using different combinations of datasets (TM phase, TM resistivity, TE phase and TE resistivity). The PW inversion mesh parameters used 100 single rows, and a regularization width/depth ratio of 0.01. The finite element and regularization meshes were constructed using frequencies at 10k, 1k, 100, 10 and 0.1 Hertz, a column width of 50 meters, 100 rows maximum and a minimum row-thickness of 10 meters. The MT inversion models were calculated using the interpolated resistivity and phase curves, in the 10000 Hertz to 0.1 Hertz bandwidth, assuming a maximum of 5% error for the resistivity and 3 degrees for the phase, at a minimum of 12 equi-spaced frequencies per decade.

The PW models were derived as follow:

1. Line# pum\_hrp\_it#: Conjugate PW inversions derived from inverting the 1D fitted and interpolated data, with no rotation of the principal components. These models used the half space resistivity (2500 Ohm-meters) as starting models, and were constructed using TM (phase + resistivity) and TE (phase + resistivity) data.
2. Line# pum\_hm\_it#: Conjugate PW inversions derived from inverting the 1D fitted and interpolated data, with no rotation of the principal components. These models used the half space resistivity (2500 Ohm-meters) as starting models, and were constructed using TM (phase + resistivity) data.

For QA/QC the inversion results, it is useful to review the actual data input into the 2D inversions and all the raw data, which is available in the Project Logistical Report submitted previously. Only the final models of the DC, IP and MT inversion results used for the interpretation are shown in this appendix. Note that the inversion models presented are not always derived from the final iteration of the inversion program. Other inversion models are also available for review and interpretation on the digital archive supplied with this report.

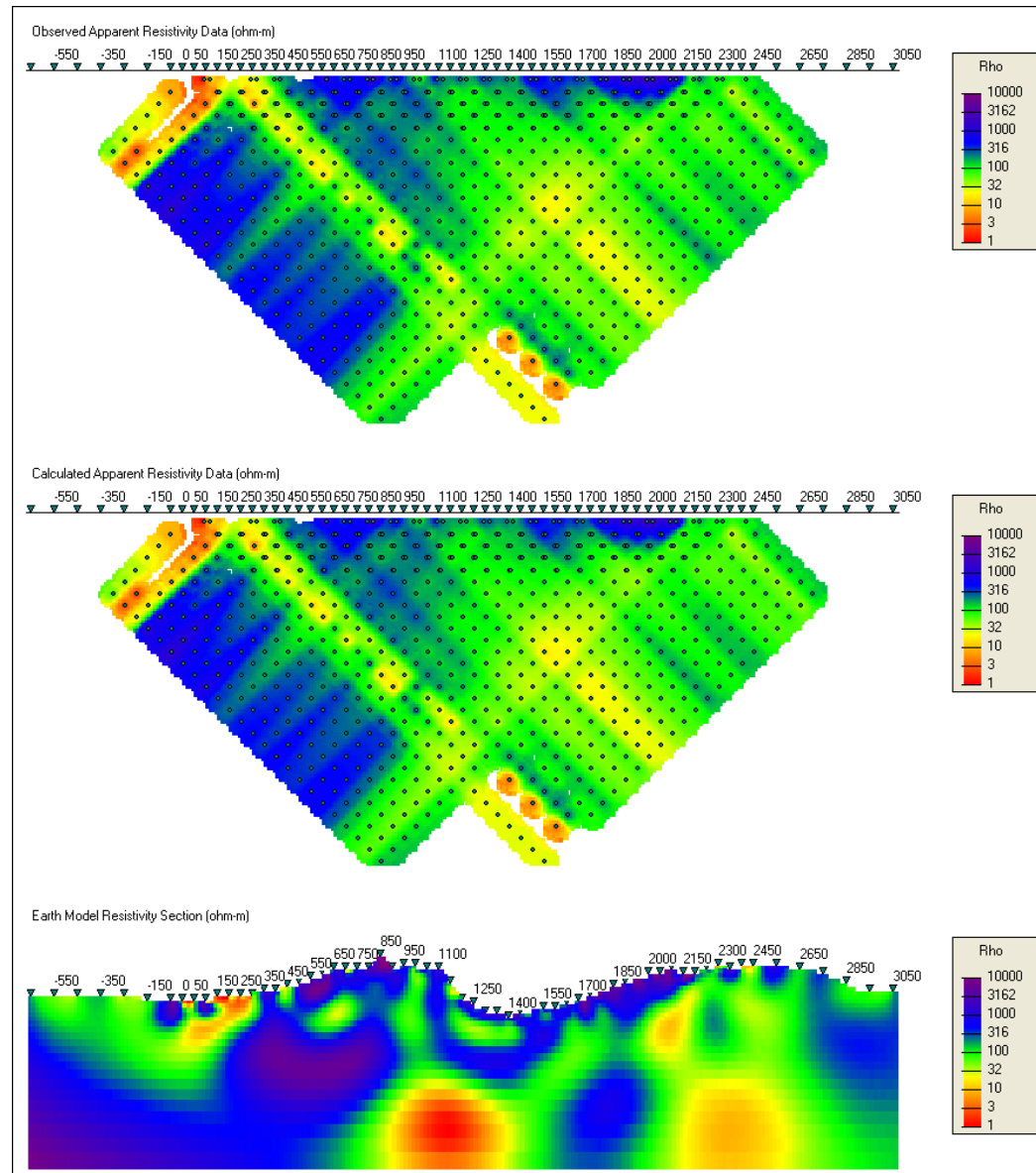
The following pages will present set figures containing the 2D DCIP and MT raw data and the inversion results, in ascending order as:

- a) 2D DC Resistivity Unconstrained Inversion Results with Observed Data and Calculated Models.
- b) 2D IP Unconstrained Inversion Results (using homogeneous conductivity model) with Observed Data and Calculated Models.
- c) 2D IP Unconstrained Inversion Results (using the Titan conductivity model) with Observed Data and Calculated Models.
- d) 2D MT unrotated Interpolated Raw Data input to the inversions.
- e) 2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM-TE (Phs+Rho)
- f) 2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM (Phs+Rho)

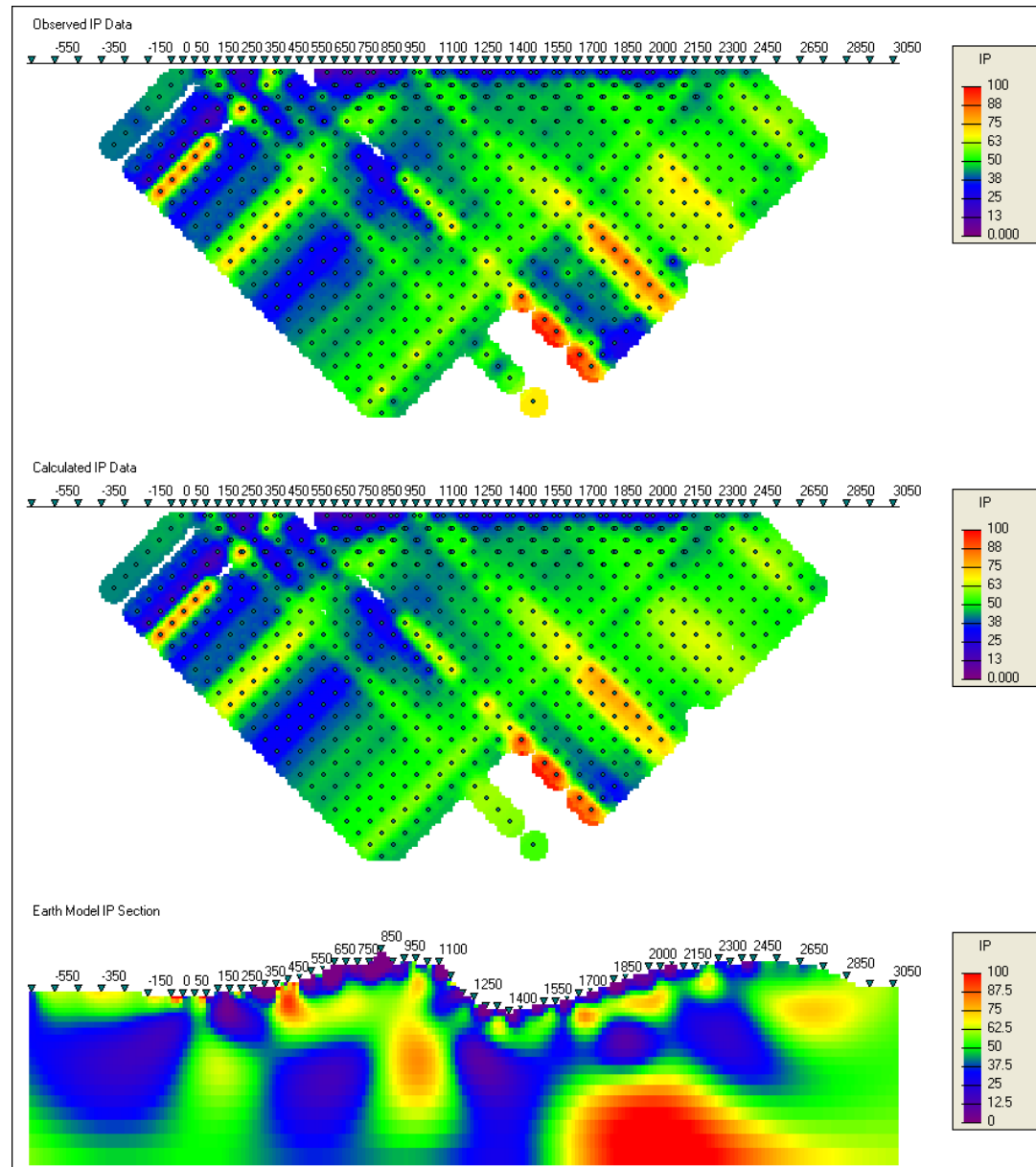
<sup>12</sup> MT 2D PW TMTE resistivity & phase Unrotated Inversion Models, starting from the half-space ~2500 Ohm-metres.

<sup>13</sup> MT 2D PW TM resistivity & phase Unrotated Inversion Models, starting from the half-space ~2500 Ohm-metres.

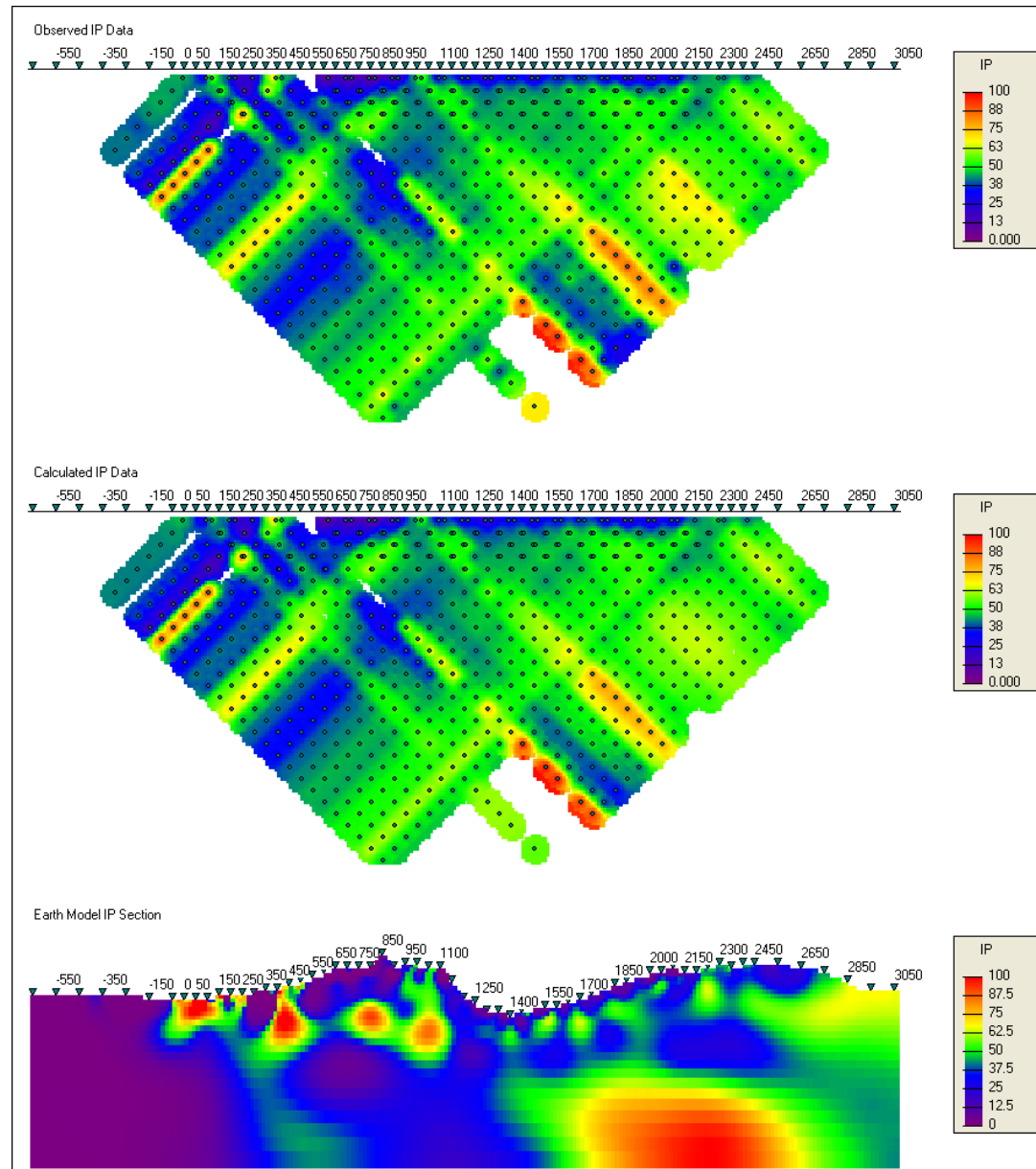
Line L0N



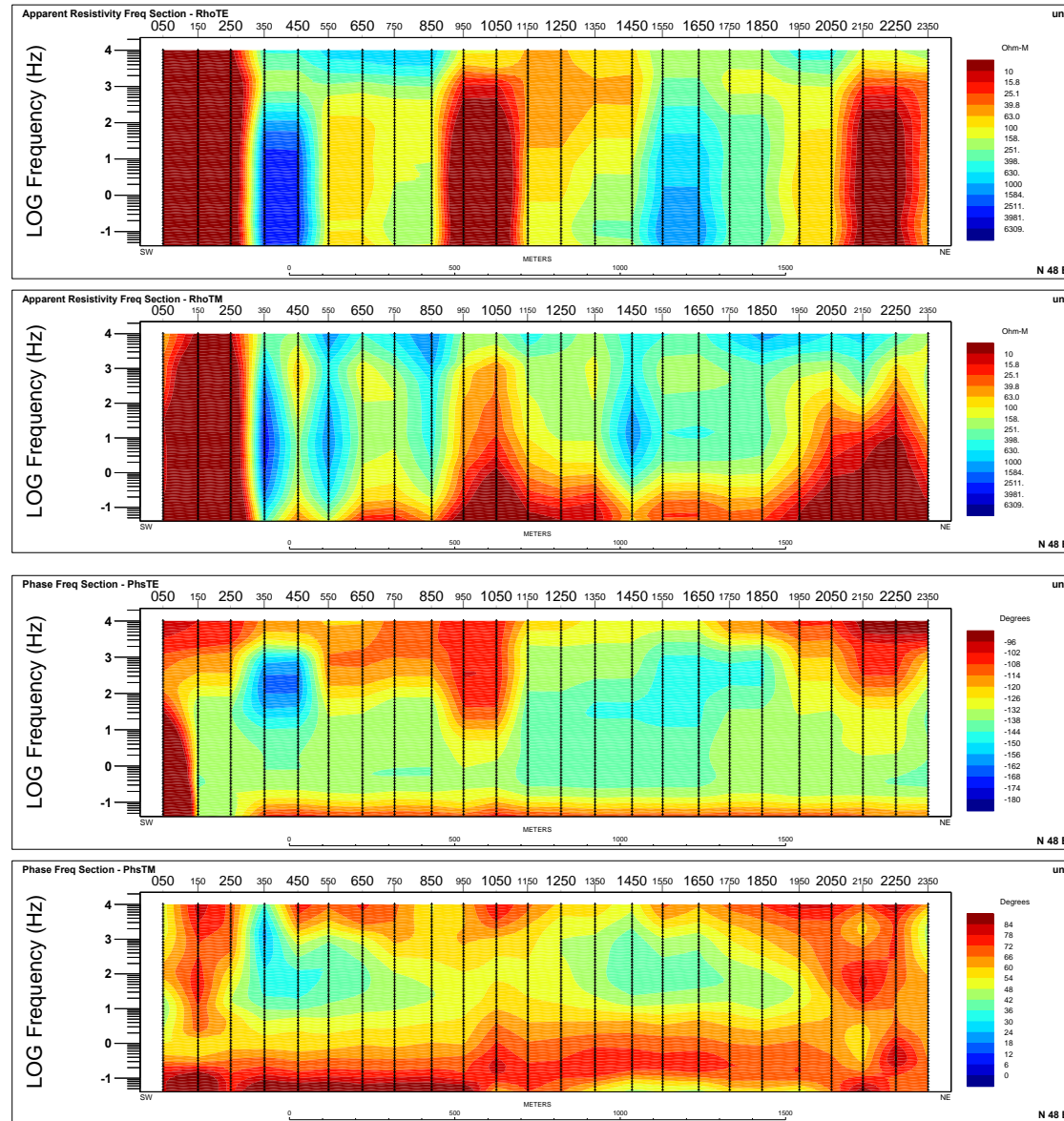
a) ***2D DC Resistivity Unconstrained Inversion Results with Observed Data and Calculated Models***



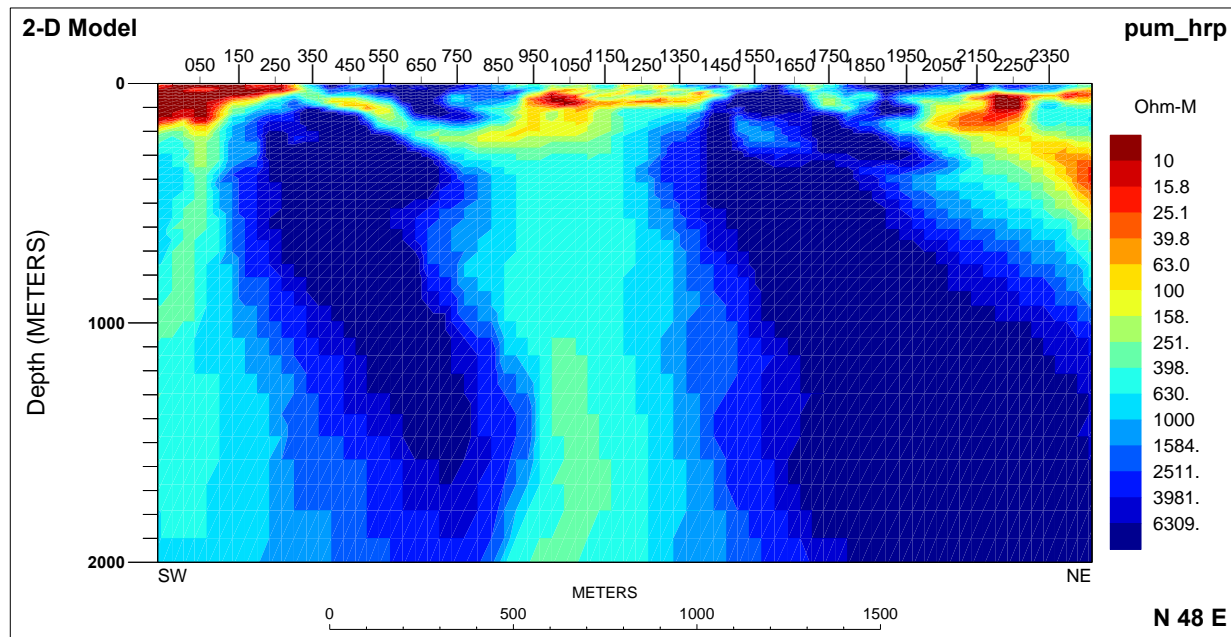
***b) 2D IP Unconstrained Inversion Results (using homogeneous conductivity model) with Observed Data and Calculated Models***



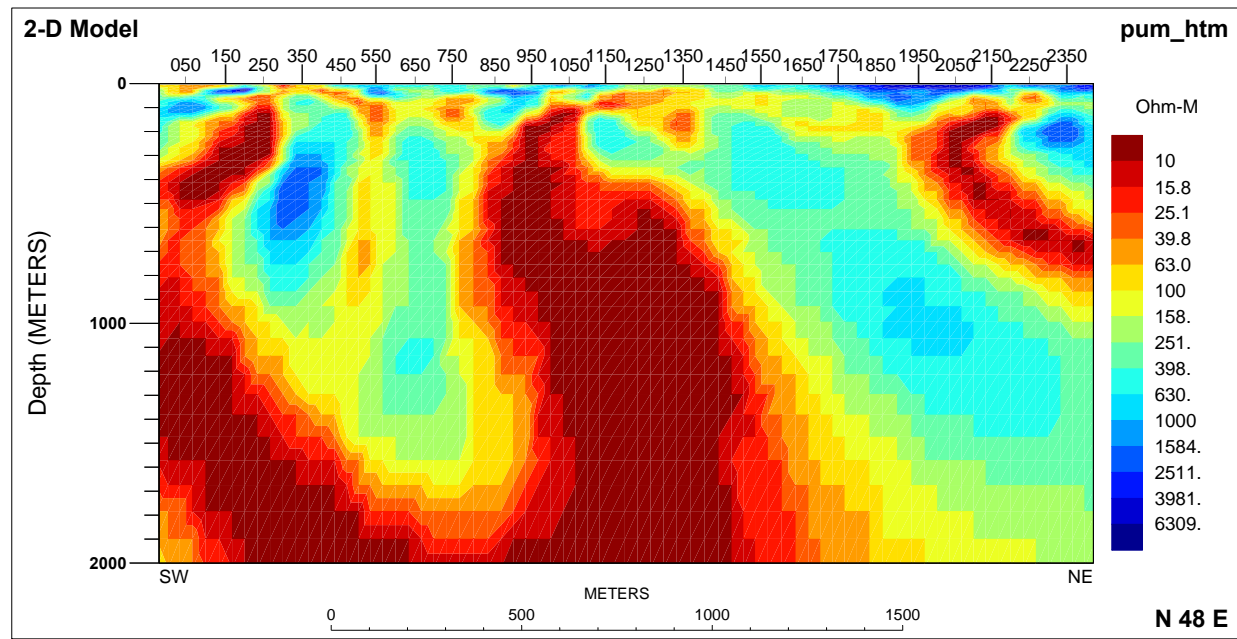
**c) 2D IP Unconstrained Inversion Results (using the Titan conductivity model) with Observed Data and Calculated Models**



**d) 2D MT unrotated Interpolated Raw Data input to the inversions**

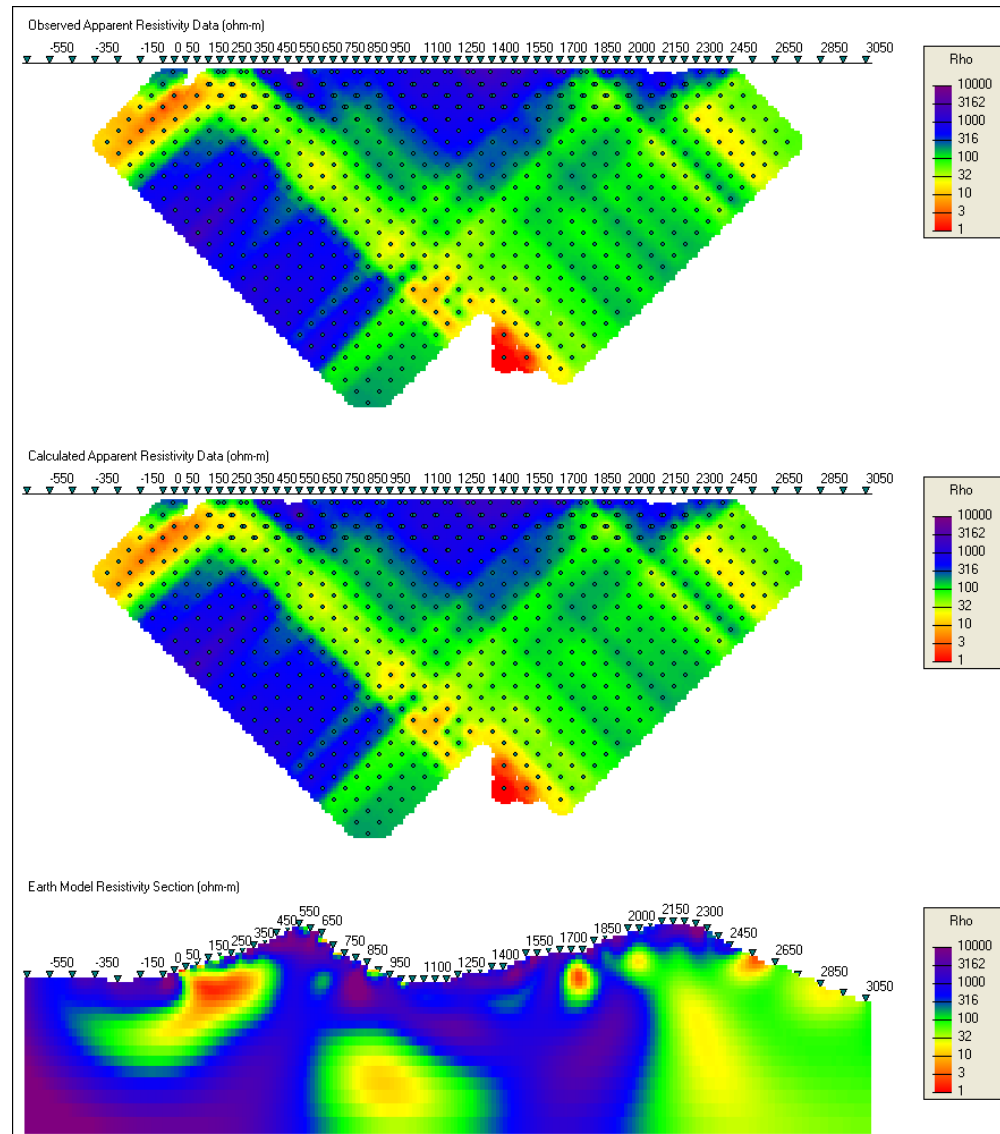


e) **2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM-TE (Phs+Rho)**

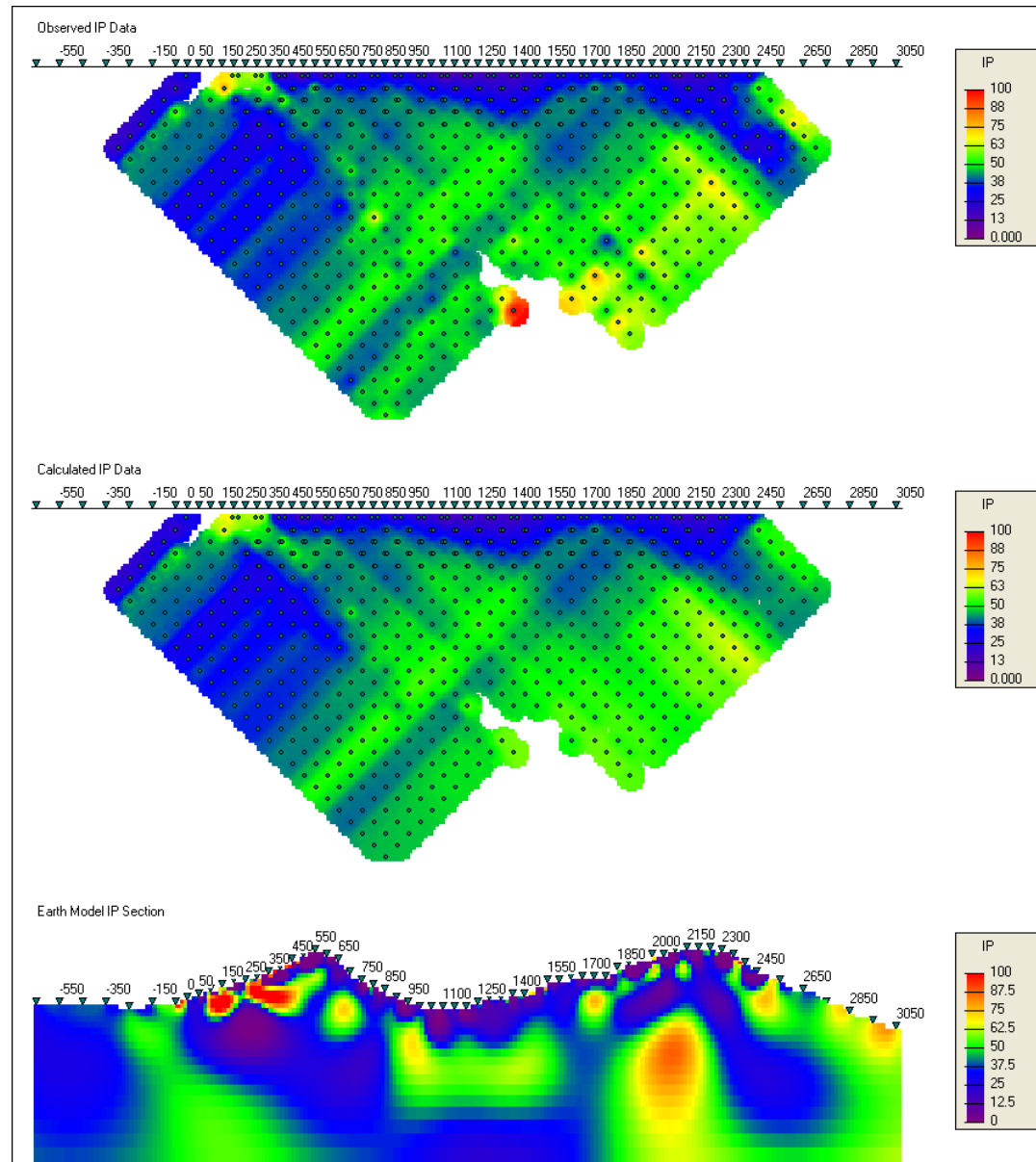


**f) 2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM (Phs+Rho)**

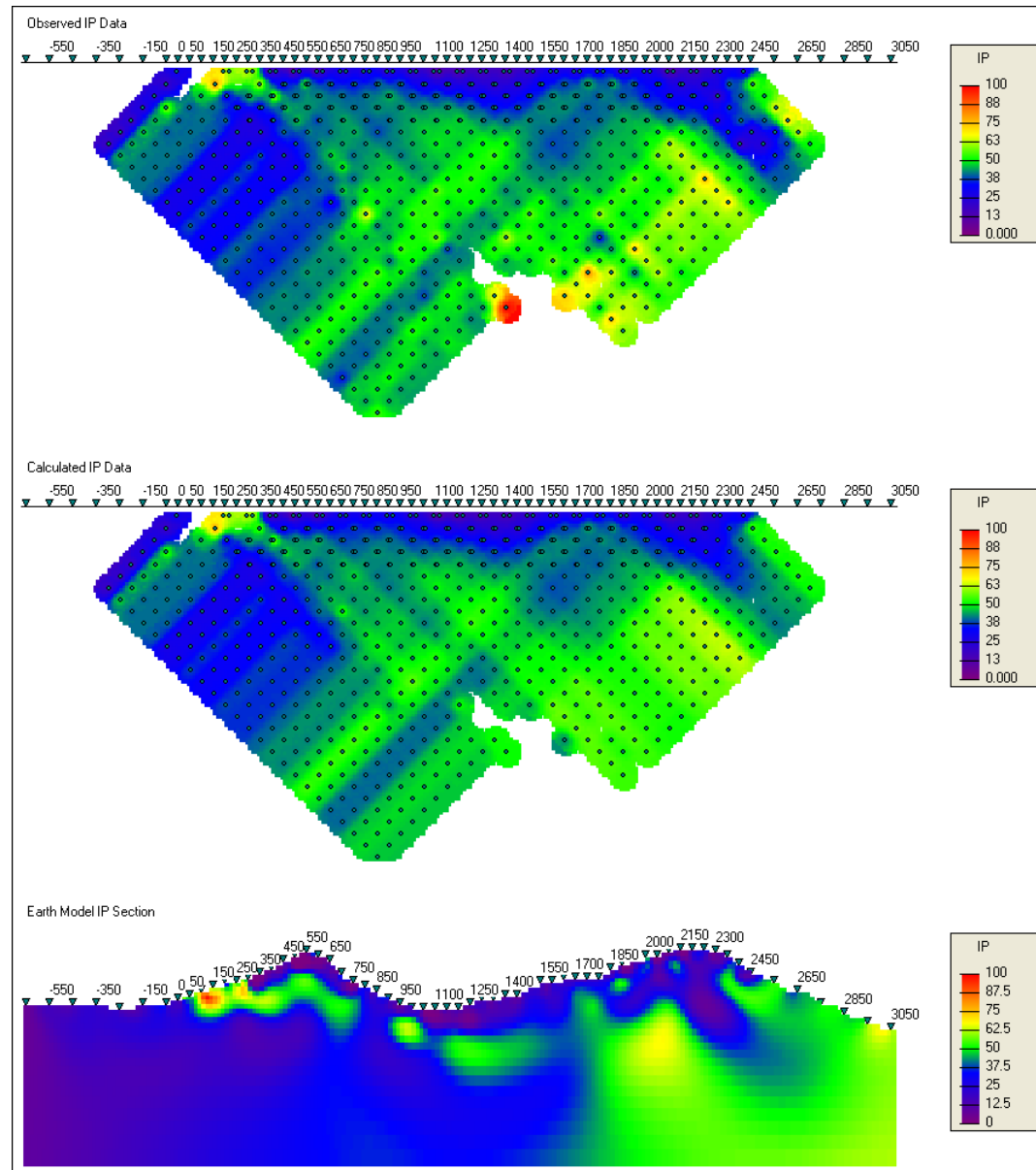
Line L400N



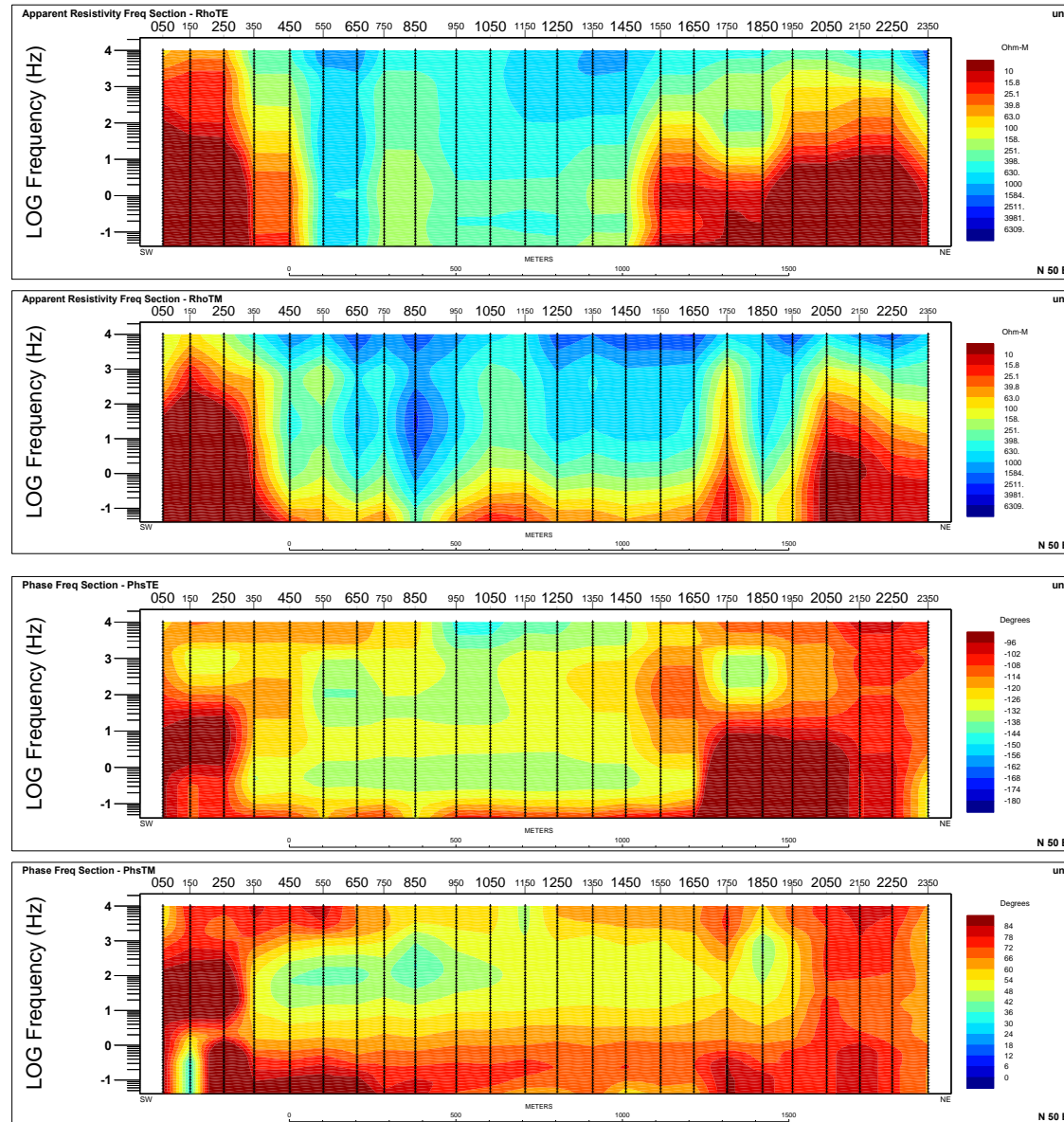
a) **2D DC Resistivity Unconstrained Inversion Results with Observed Data and Calculated Models**



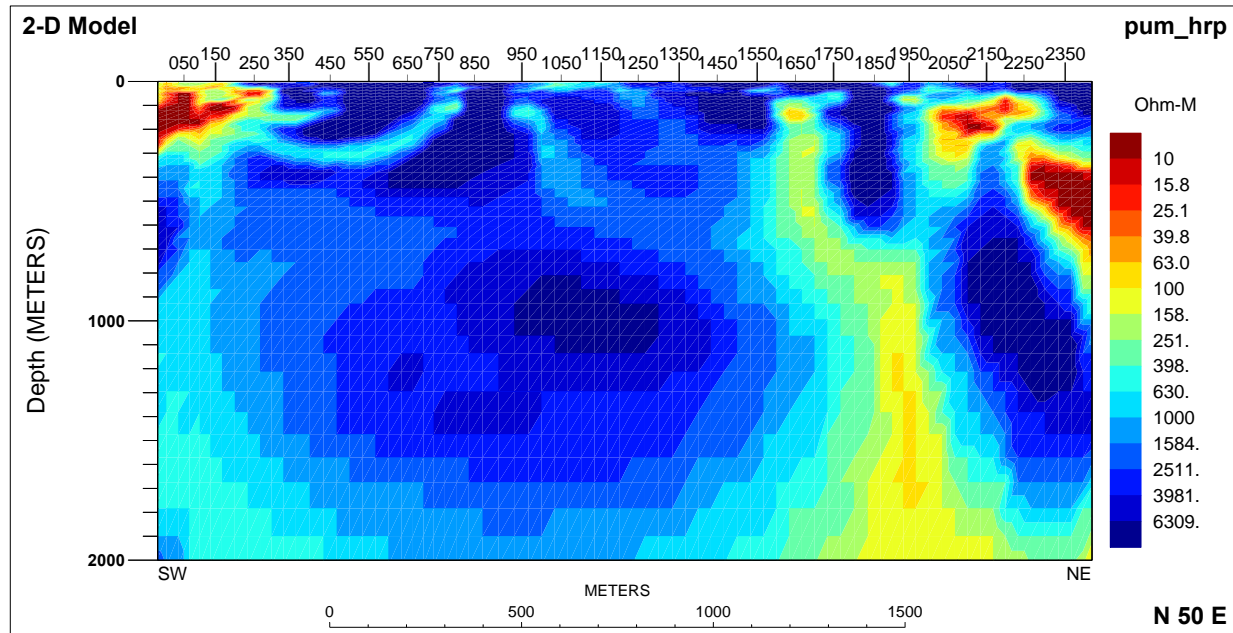
***b) 2D IP Unconstrained Inversion Results (using homogeneous conductivity model) with Observed Data and Calculated Models***



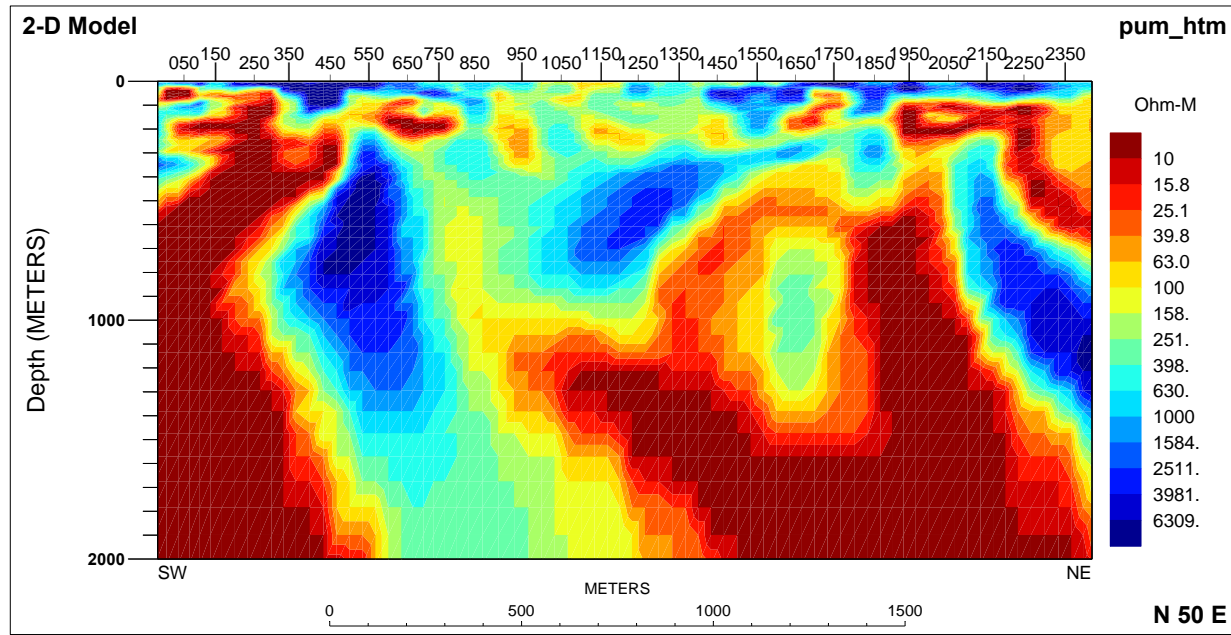
**c) 2D IP Unconstrained Inversion Results (using the Titan conductivity model) with Observed Data and Calculated Models**



**d) 2D MT unrotated Interpolated Raw Data input to the inversions**

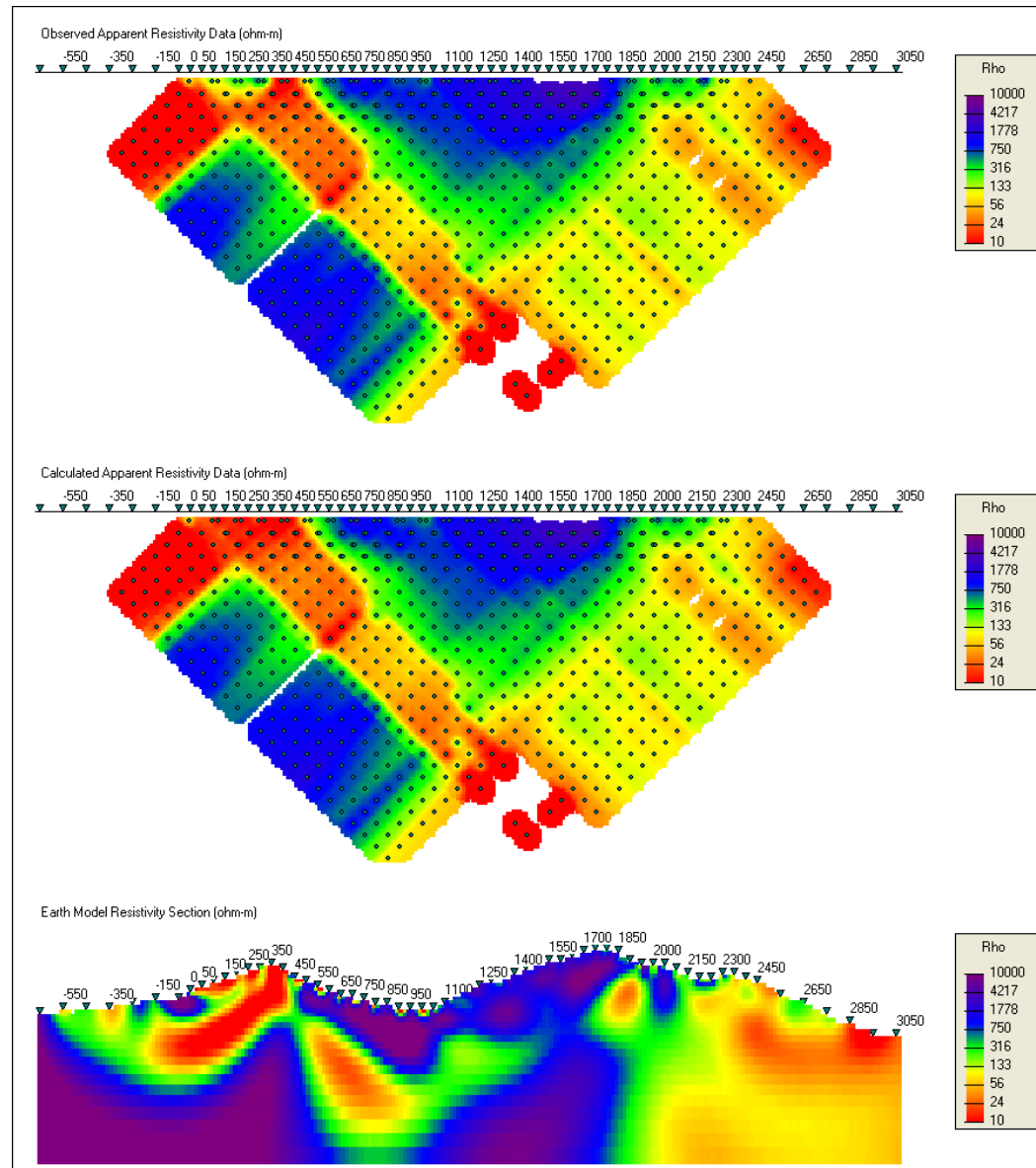


e) 2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM-TE (Phs+Rho)

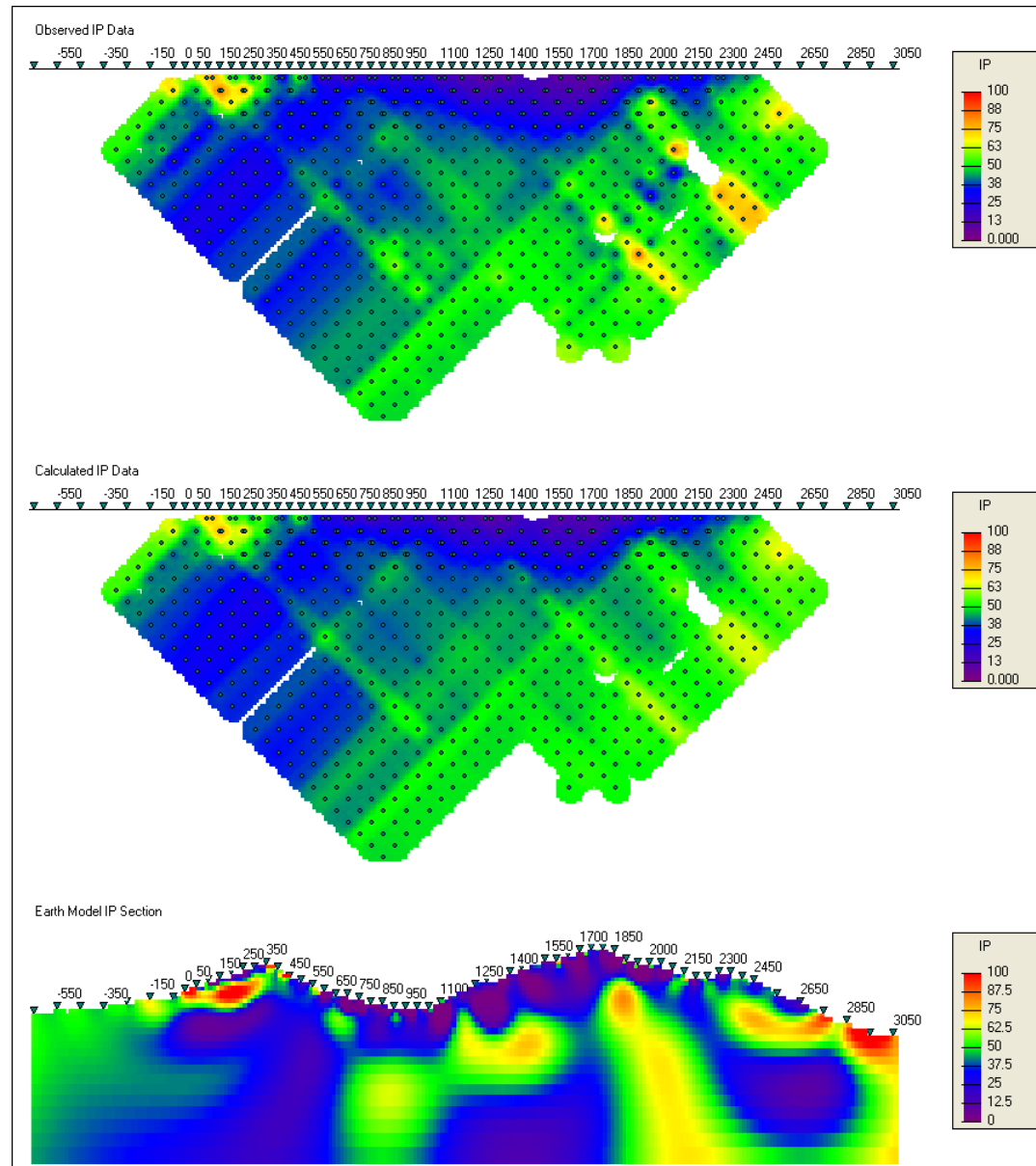


**f) 2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM (Phs+Rho)**

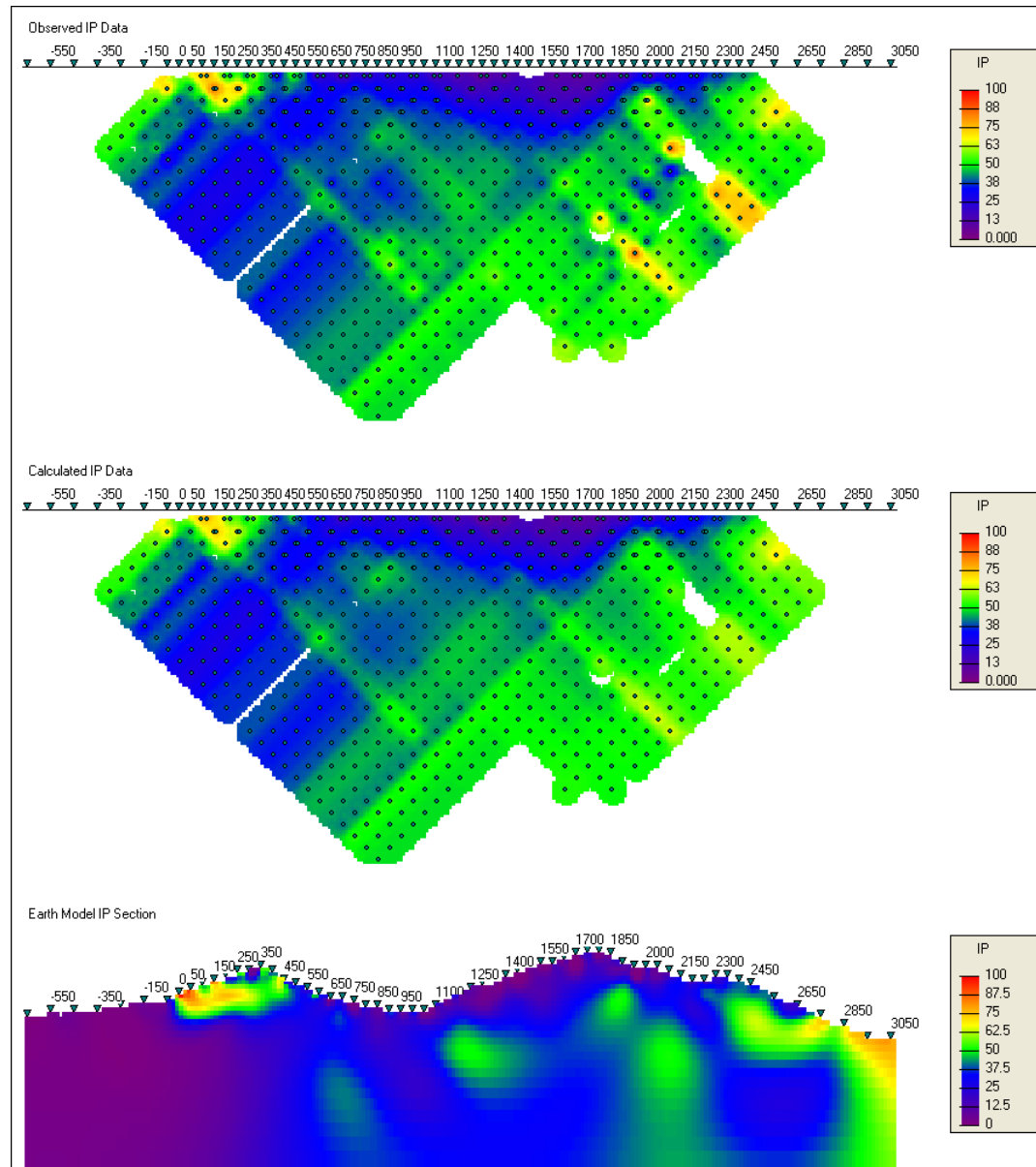
Line L600N



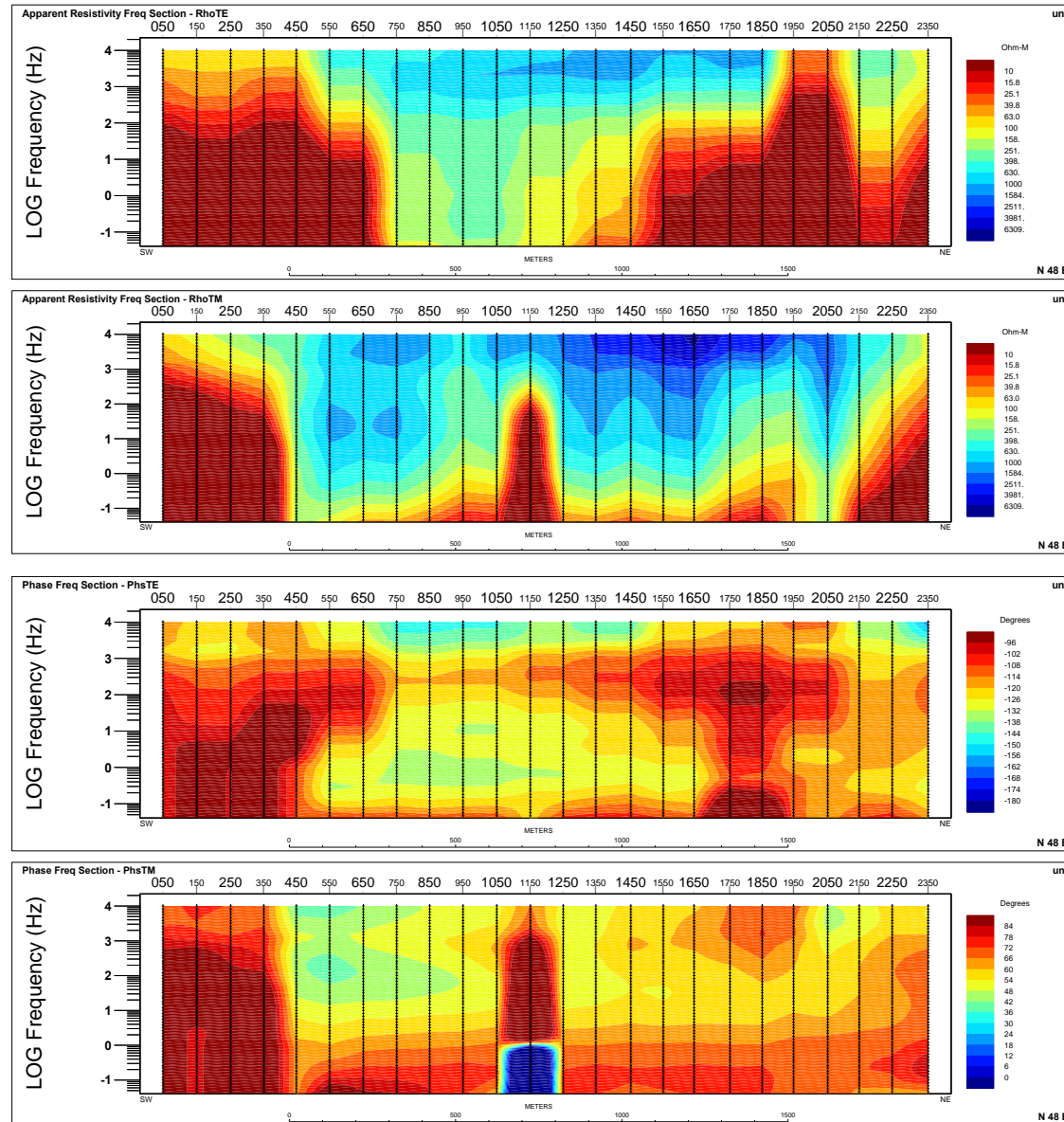
a) ***2D DC Resistivity Unconstrained Inversion Results with Observed Data and Calculated Models***



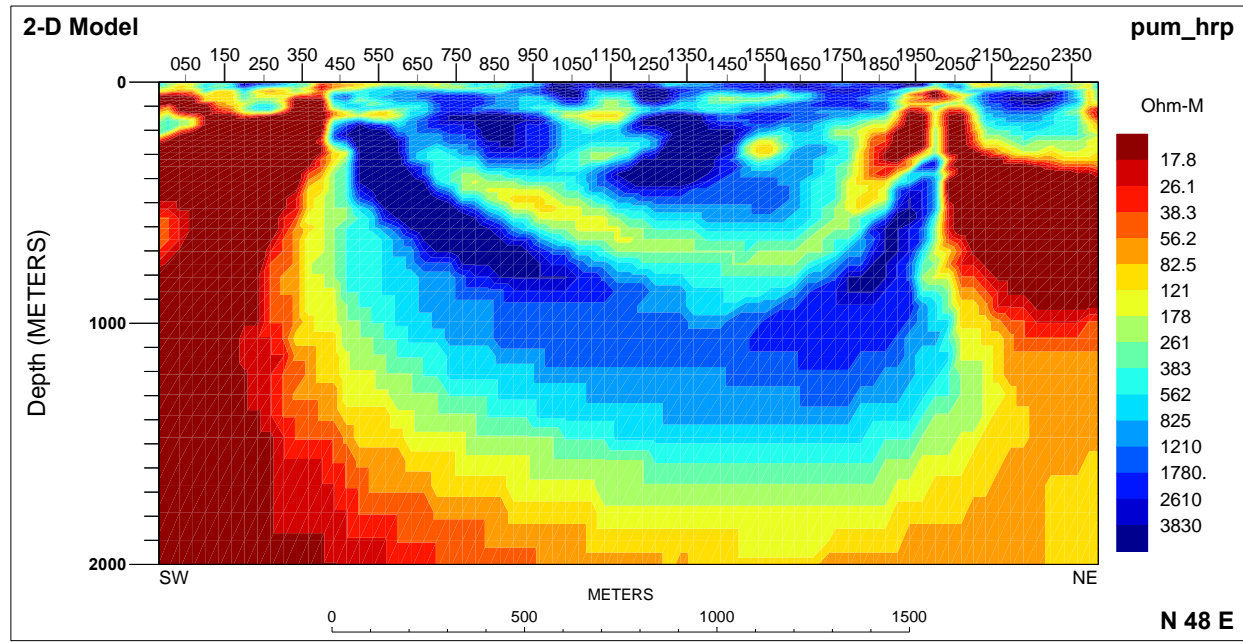
***b) 2D IP Unconstrained Inversion Results (using homogeneous conductivity model) with Observed Data and Calculated Models***



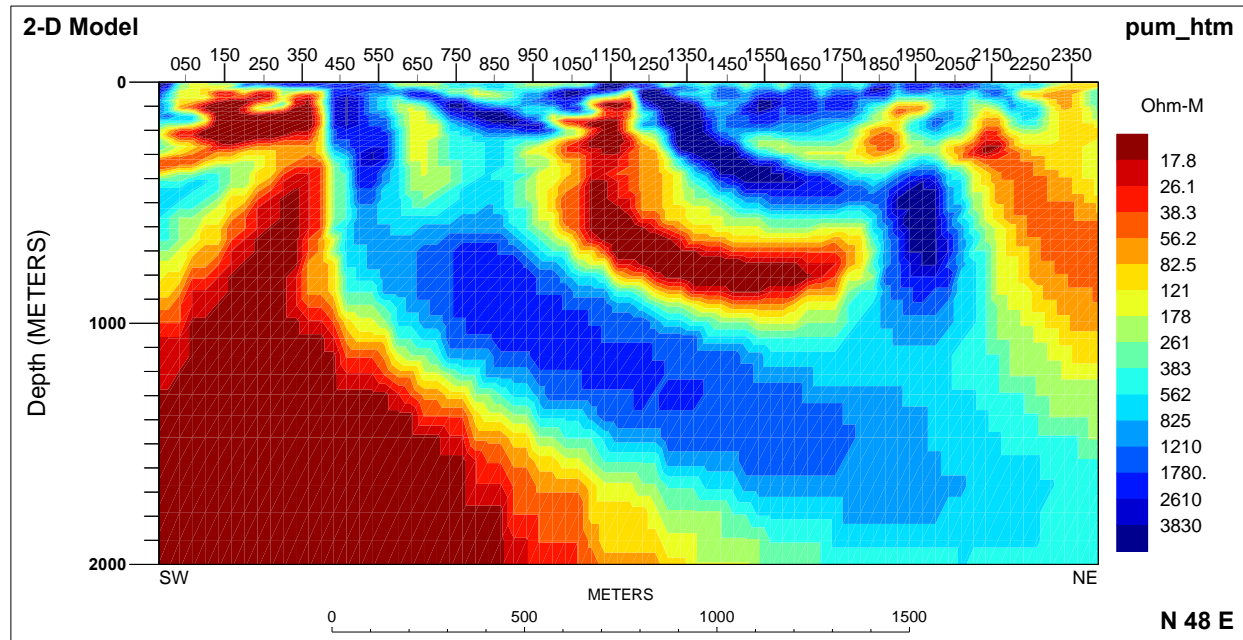
**c) 2D IP Unconstrained Inversion Results (using the Titan conductivity model) with Observed Data and Calculated Models**



**d) 2D MT unrotated Interpolated Raw Data input to the inversions**



e) 2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM-TE (Phs+Rho)



f) ***2D MT PW Unrotated model from half space resistivity = 2500 Ohm-meters. Data inverted = TM (Phs+Rho)***

## APPENDIX F: OASIS SECTIONS AND PLAN MAPS<sup>1</sup>

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<sup>1</sup> The Oasis Sections presented in this appendix are also available in the Digital Archive attached to this Interpretation Report. All the Sections and Maps have been re-scaled to fit the paper size. For viewing original-scaled plots install the OasisMontaj Viewer supplied in the digital archive or download from the Geosoft Site at <http://www.geosoft.com/pinfo/oasismontaj/free/montajviewer.asp>

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## II. Geosoft Sections

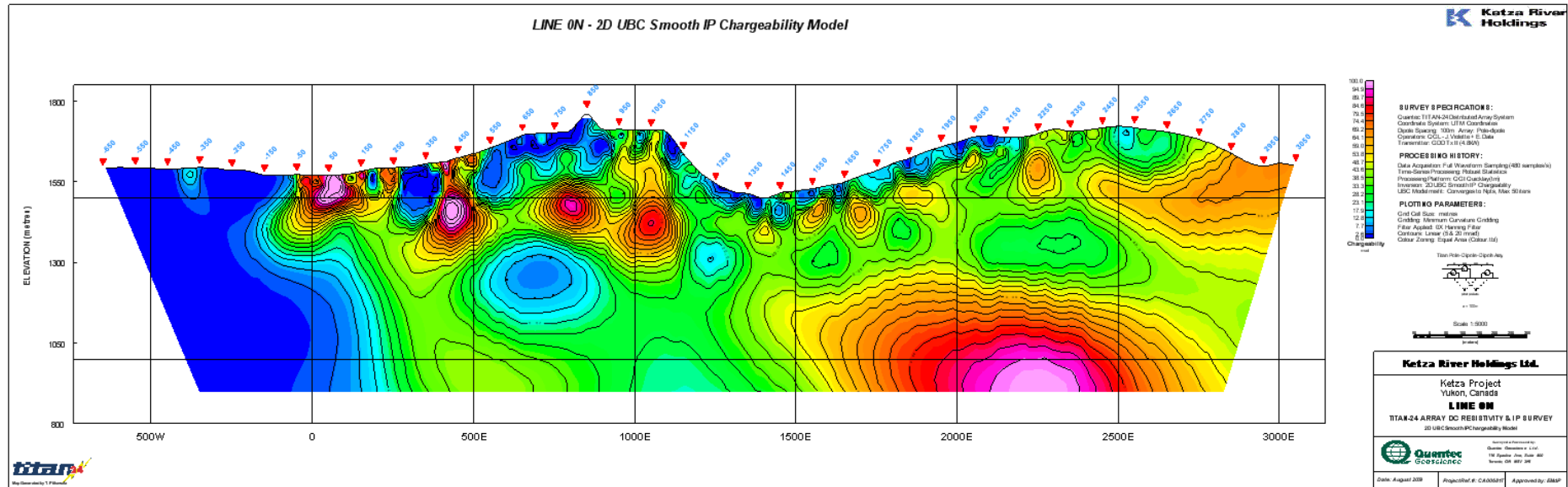


Figure II-1: Line L0N 2D Smooth IP Chargeability (using Titan Conductivity) Inversion Model "smIP"

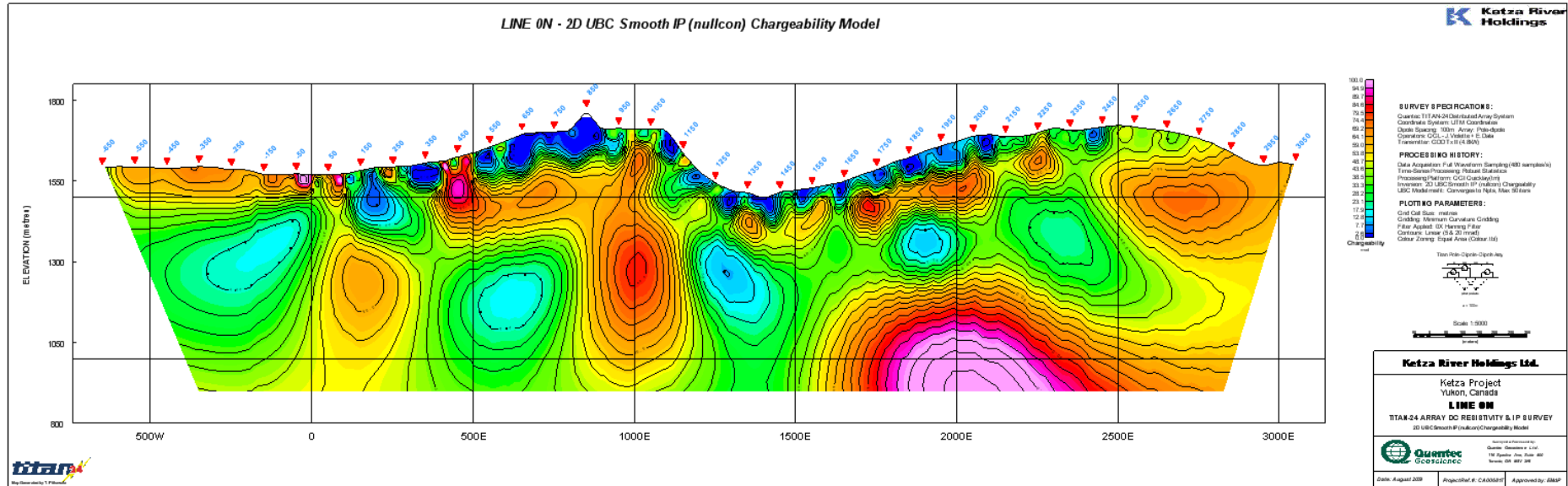


Figure II-2: Line L0N 2D Smooth IP Nullcon Chargeability Inversion Model “smIP nullcon”

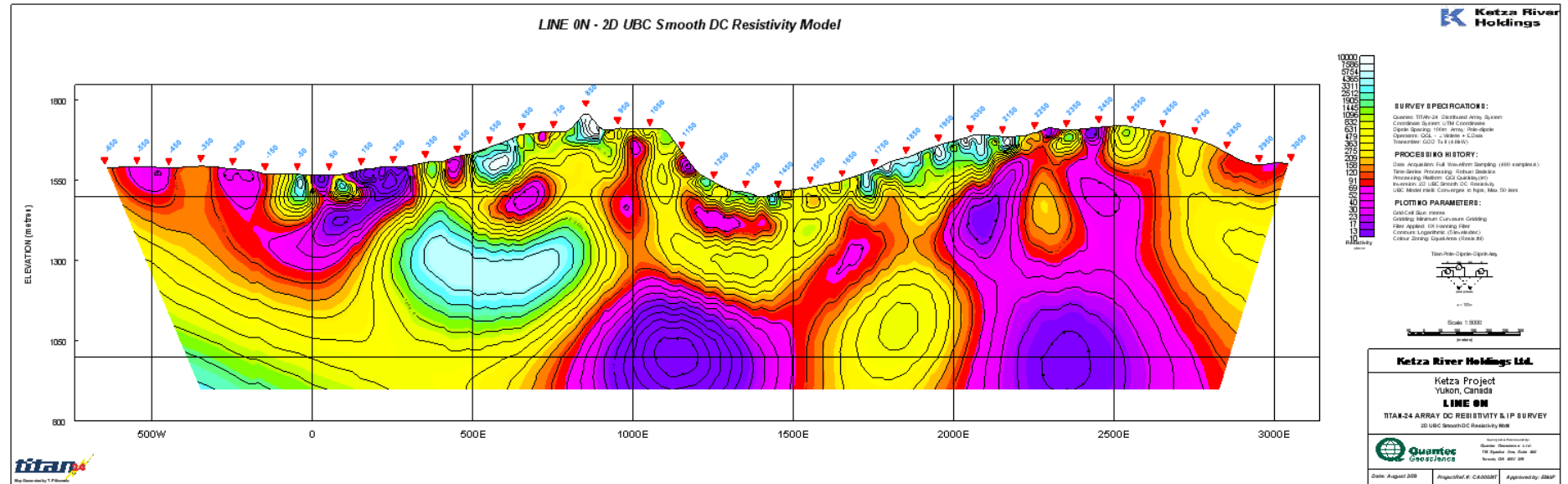


Figure II-3: Line L0N 2D Smooth DC Resistivity Inversion Model “smDC”

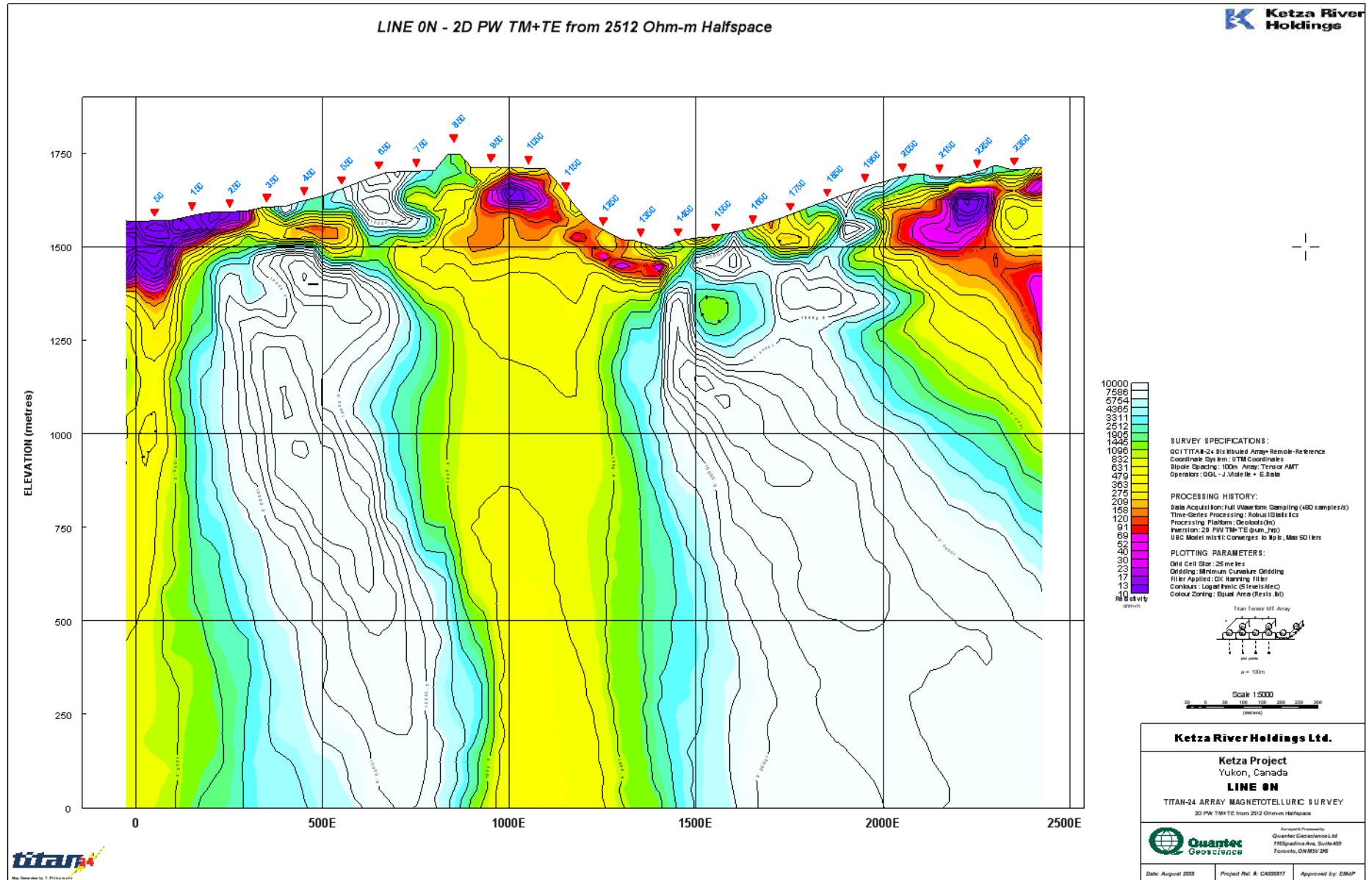


Figure II-4: Line L0N 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Inversion Model "pum\_hp"

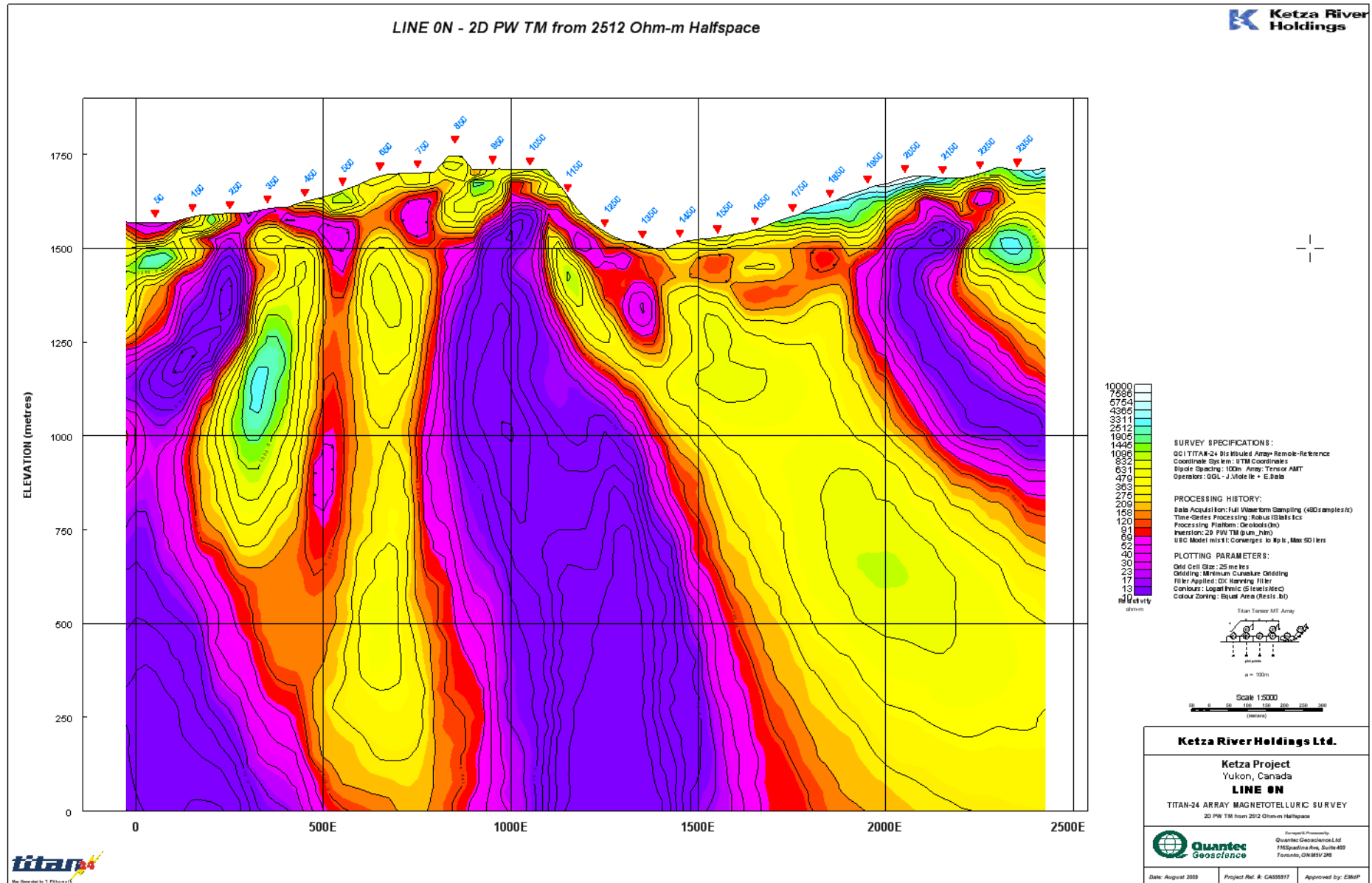


Figure II-5: Line L0N 2D PW (TM phs/rho) MT Resistivity Inversion Model "pvm\_hm"

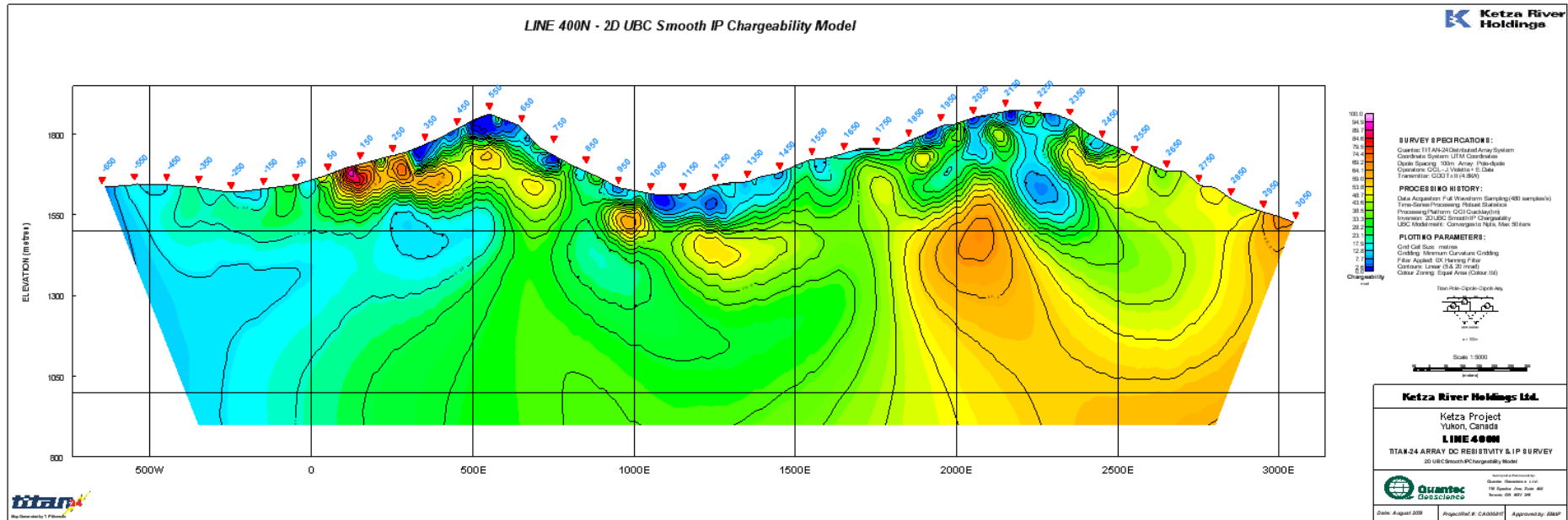


Figure II-6: Line L400N 2D Smooth IP Chargeability (using Titan Conductivity) Inversion Model "smIP"

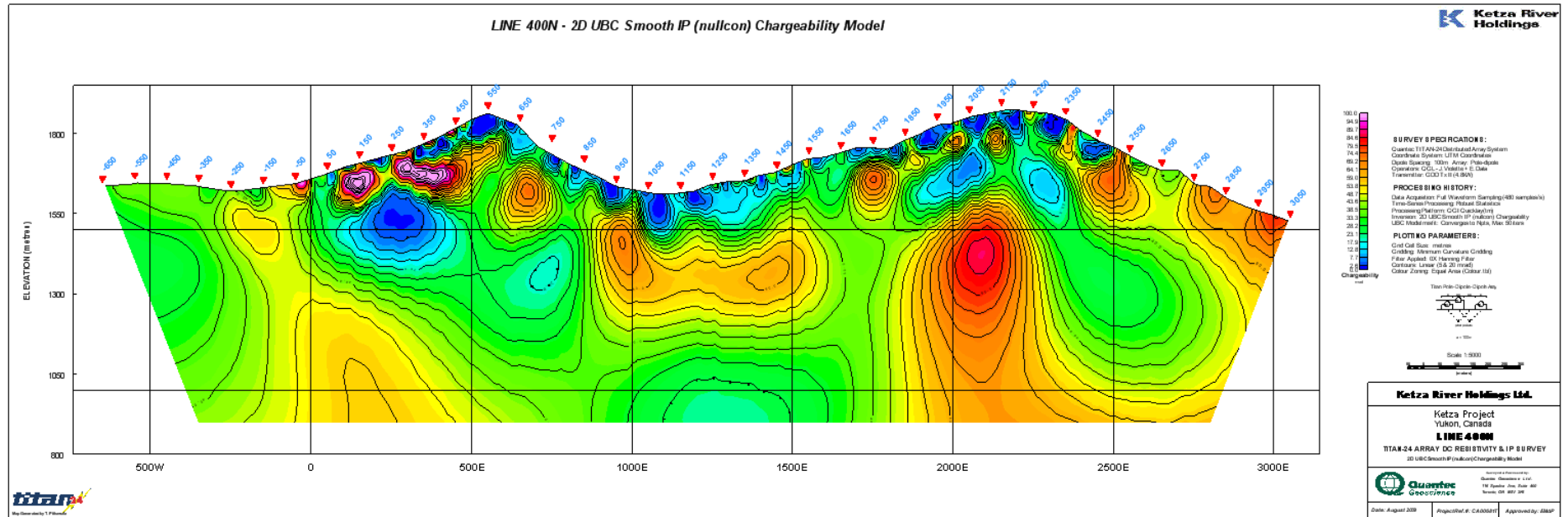


Figure II-7: Line L400N 2D Smooth IP Nullcon Chargeability Inversion Model “smIP nullcon”

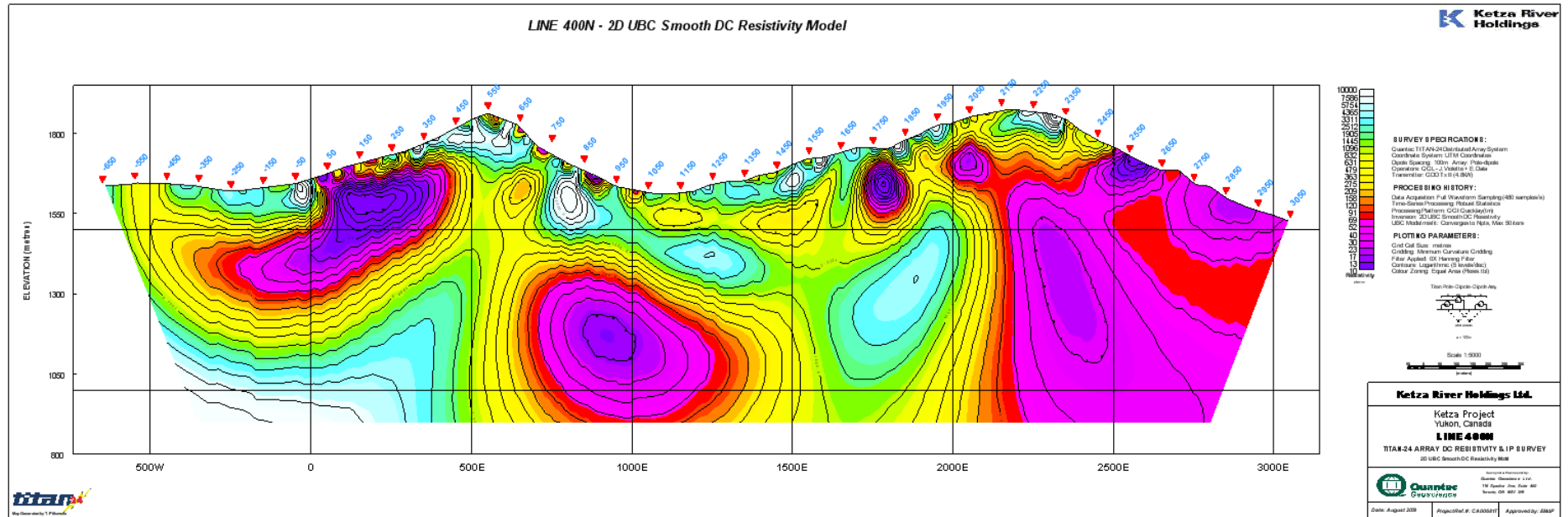


Figure II-8: Line L400N 2D Smooth DC Resistivity Inversion Model "smDC"

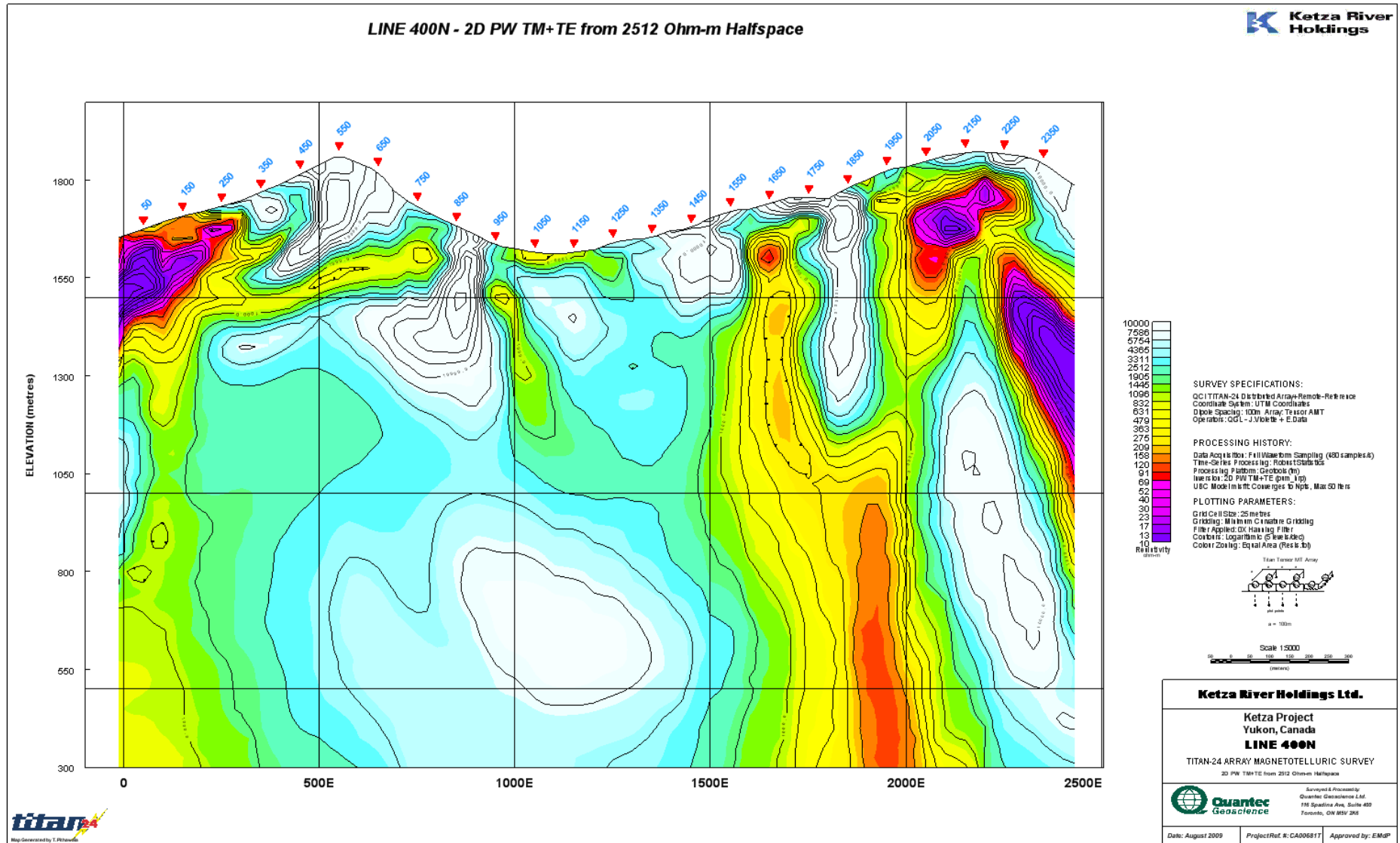


Figure II-9: Line L400N 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Inversion Model "pum\_hrp"

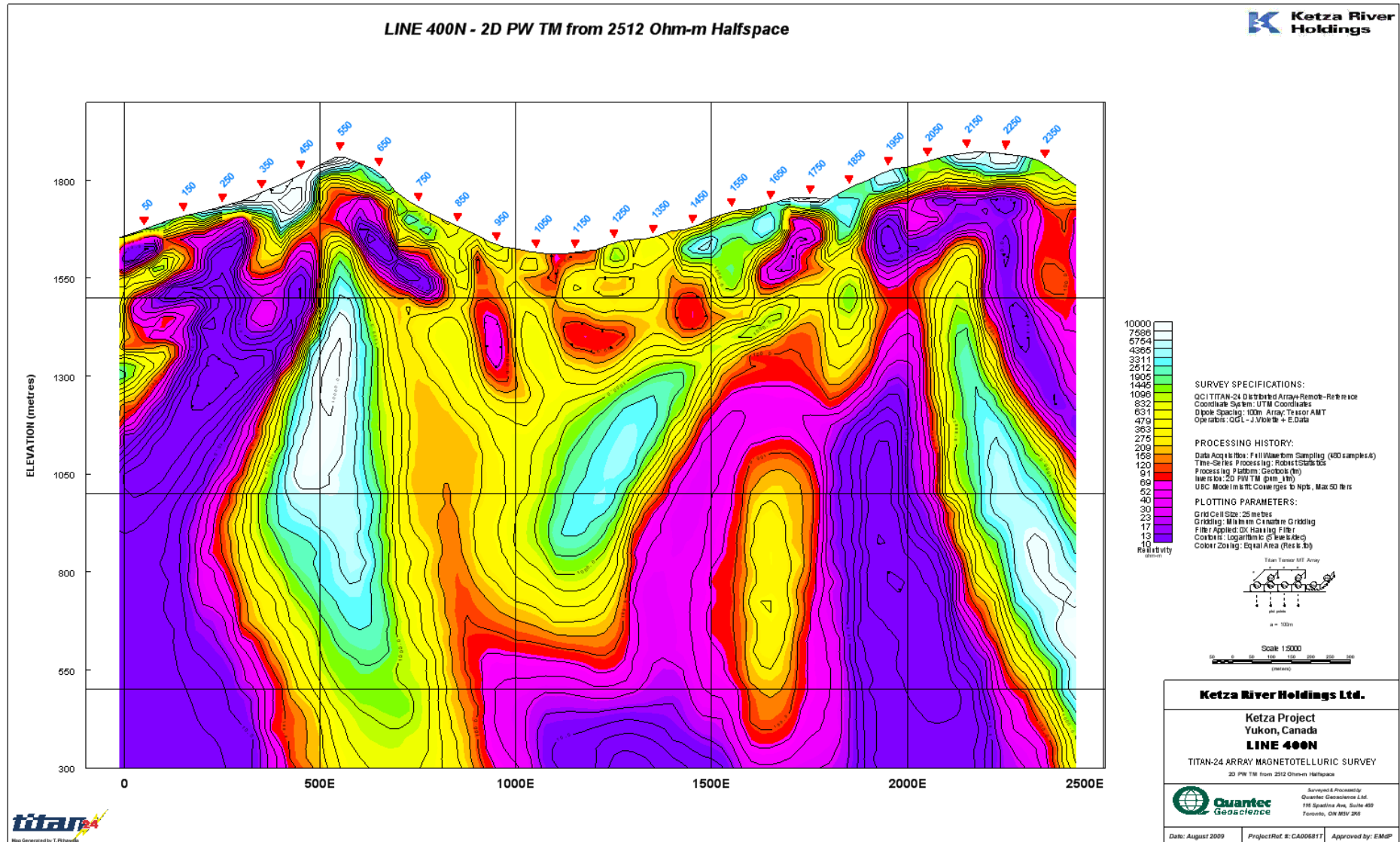


Figure II-10: Line L400N 2D PW (TM phs/rho) MT Resistivity Inversion Model "pwm\_htm"

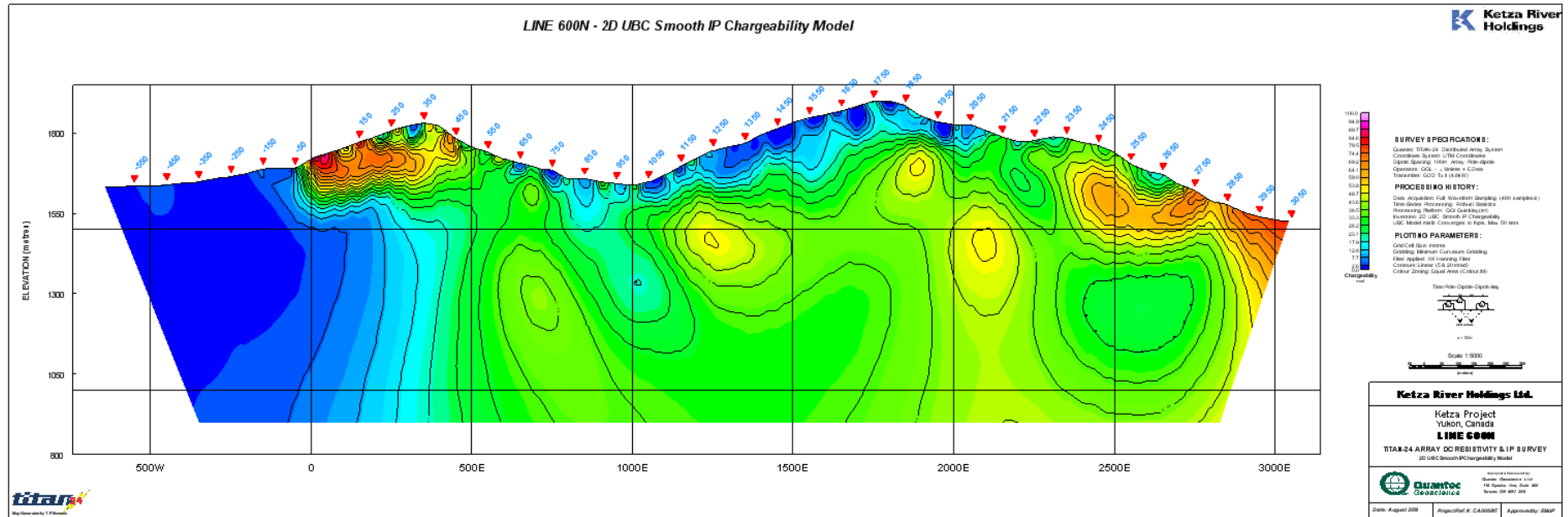


Figure II-11: Line L600N 2D Smooth IP Chargeability (using Titan Conductivity) Inversion Model “smIP”

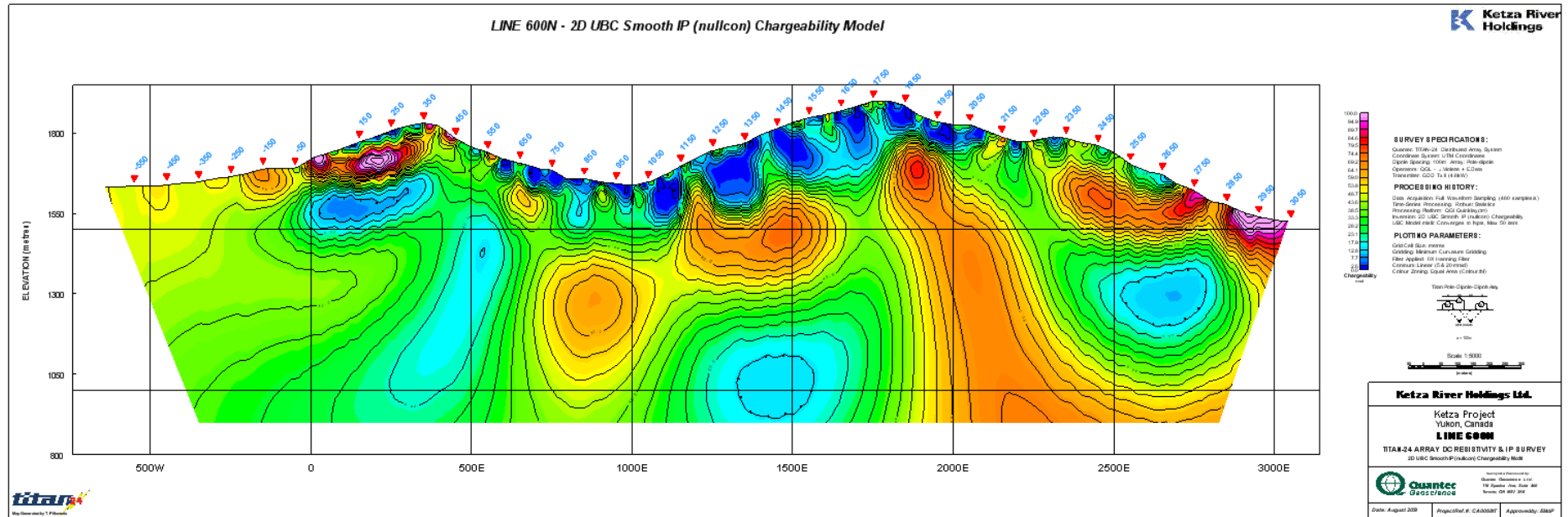


Figure II-12: Line L600N 2D Smooth IP Nullcon Chargeability Inversion Model “smIP nullcon”

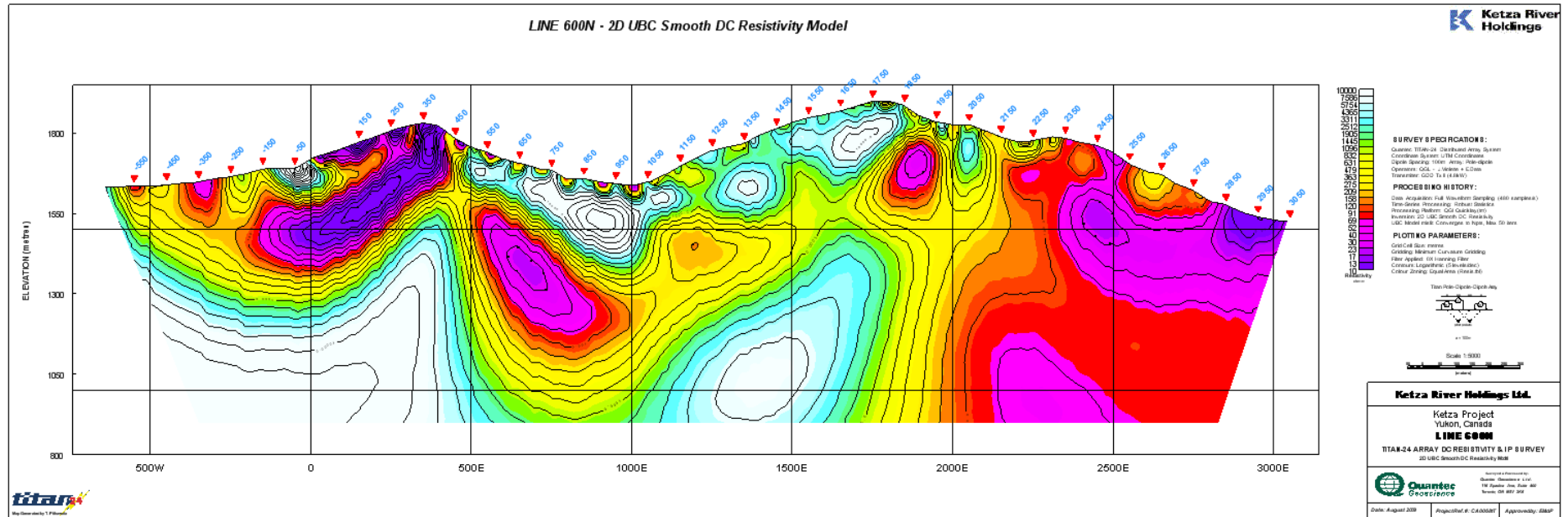


Figure II-13: Line L600N 2D Smooth DC Resistivity Inversion Model "smDC"

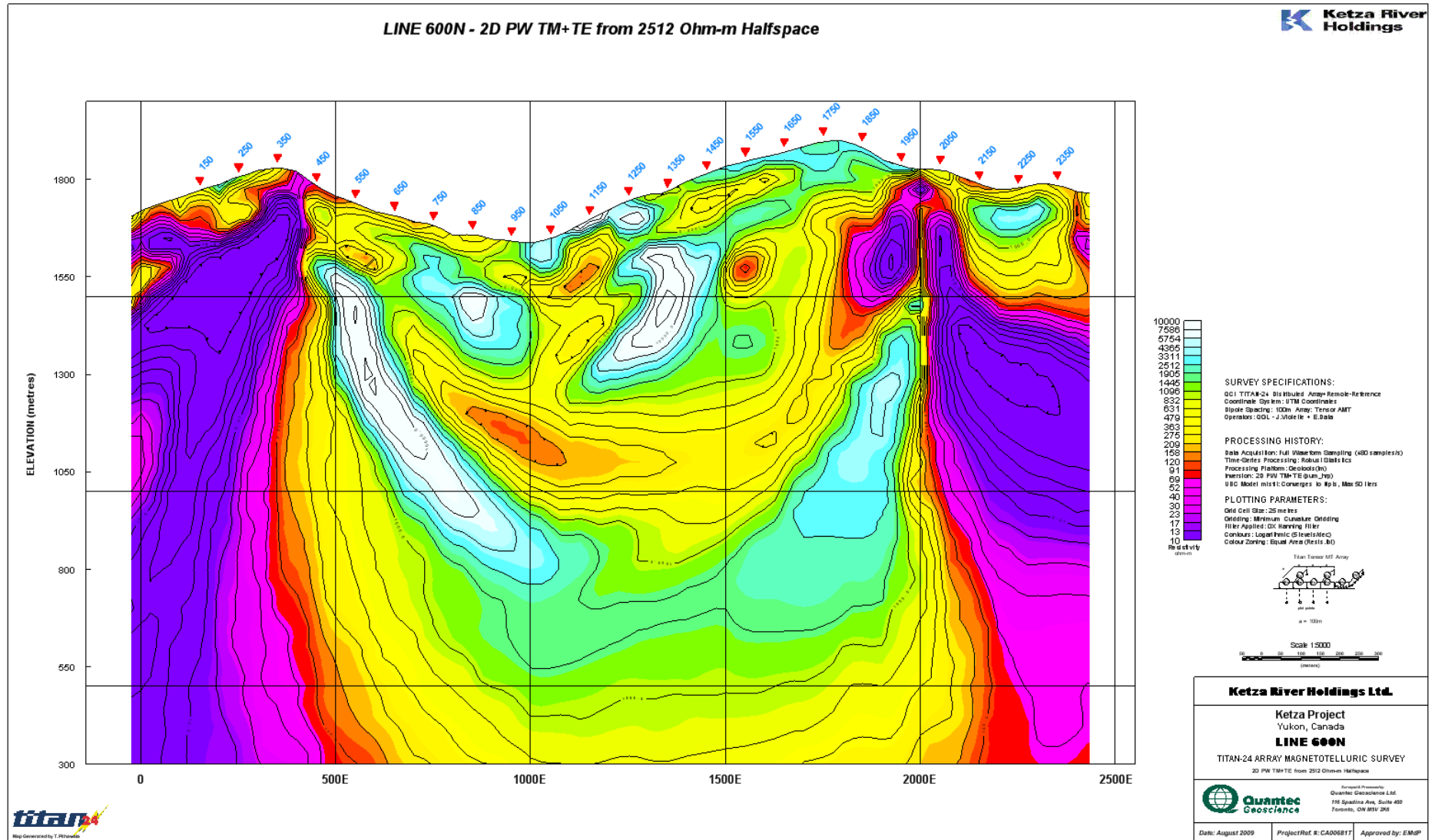


Figure II-14: Line L600N 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Inversion Model "pum\_hrp"

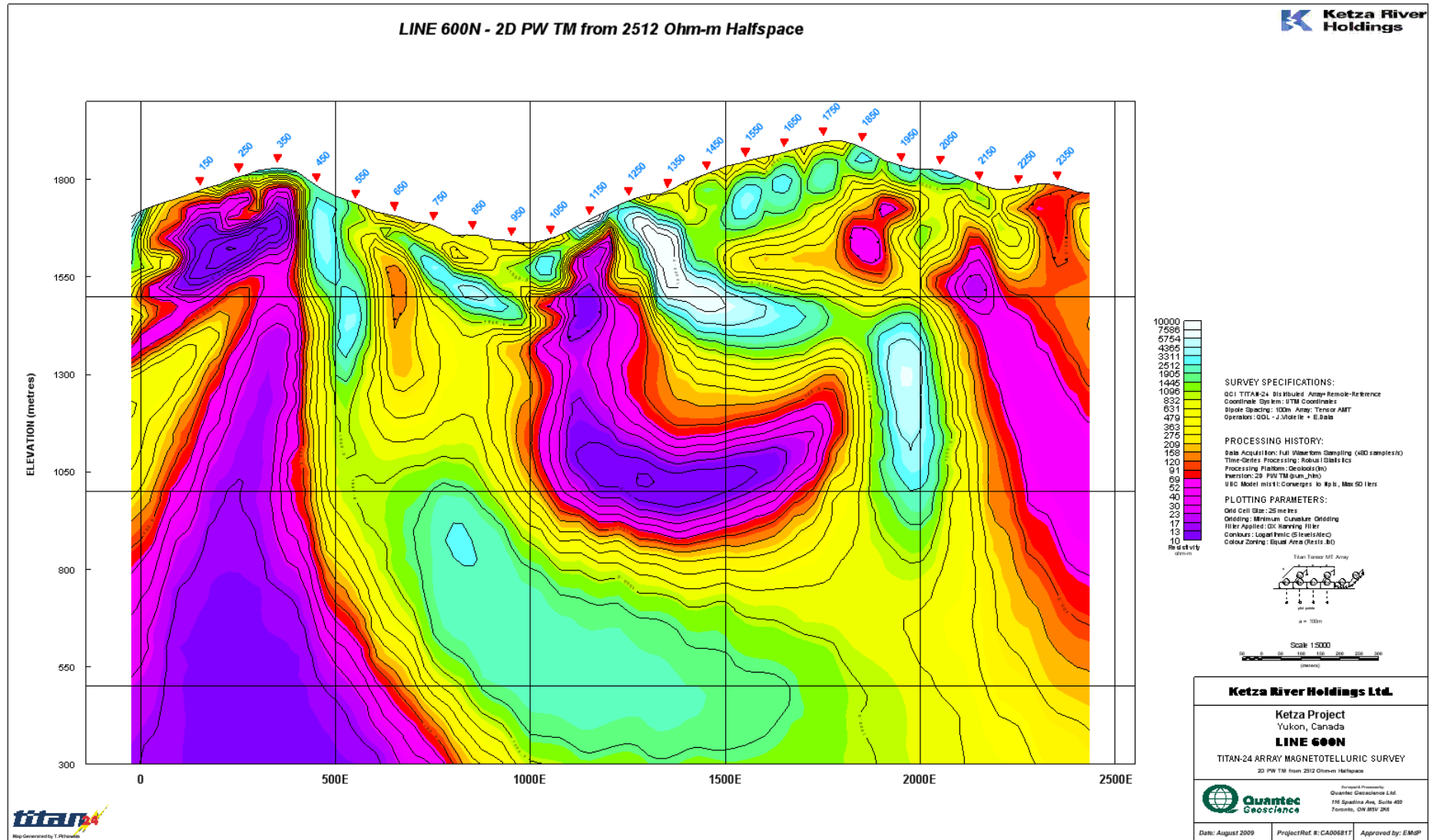


Figure II-15: Line L600N 2D PW (TM phs/rho) MT Resistivity Inversion Model "pum\_hm"

### III. Geosoft Plan Maps

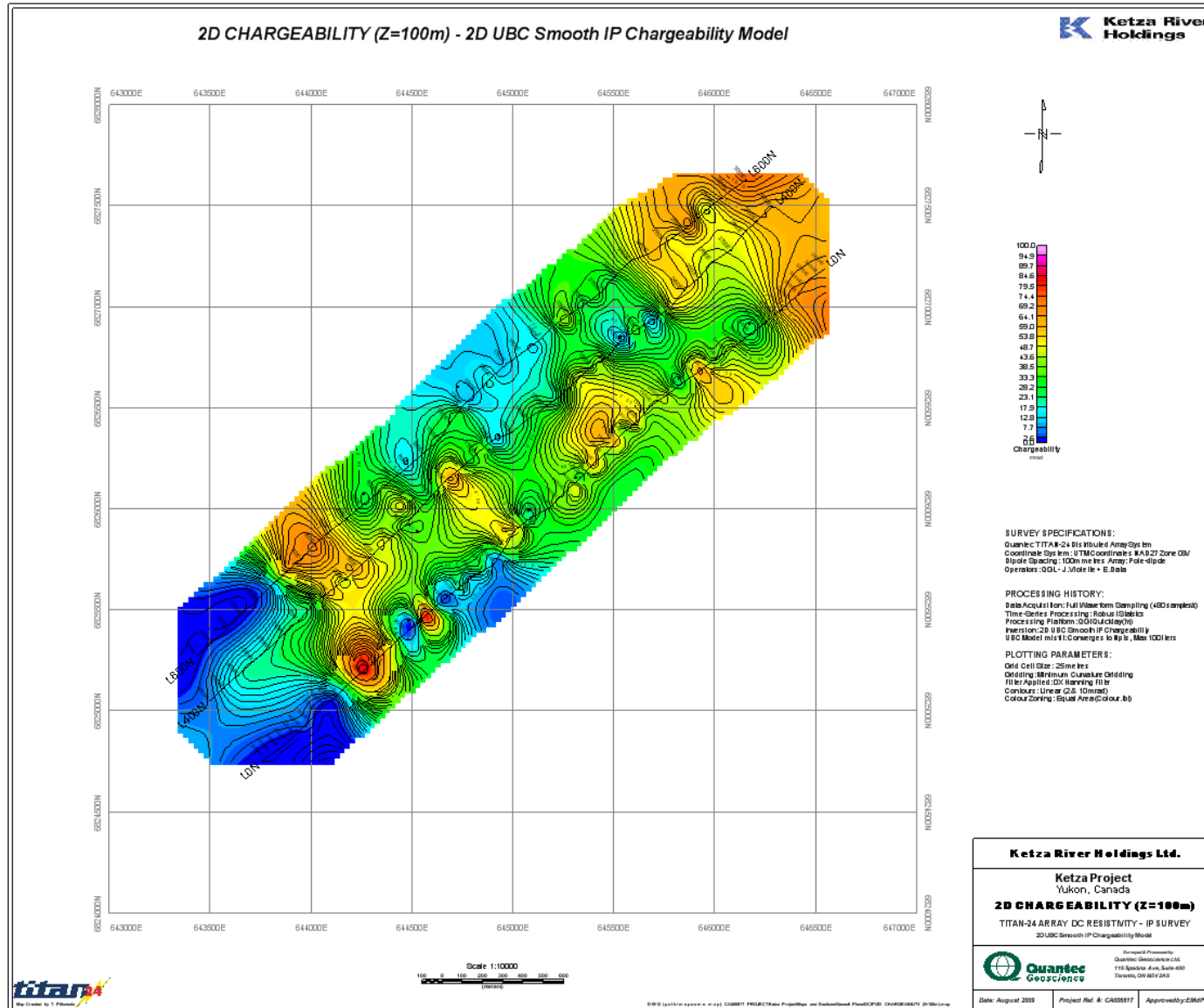


Figure III-1: 2D Smooth IP Chargeability (using Titan Conductivity) Plan Map at 100m depth “100m\_smIP”

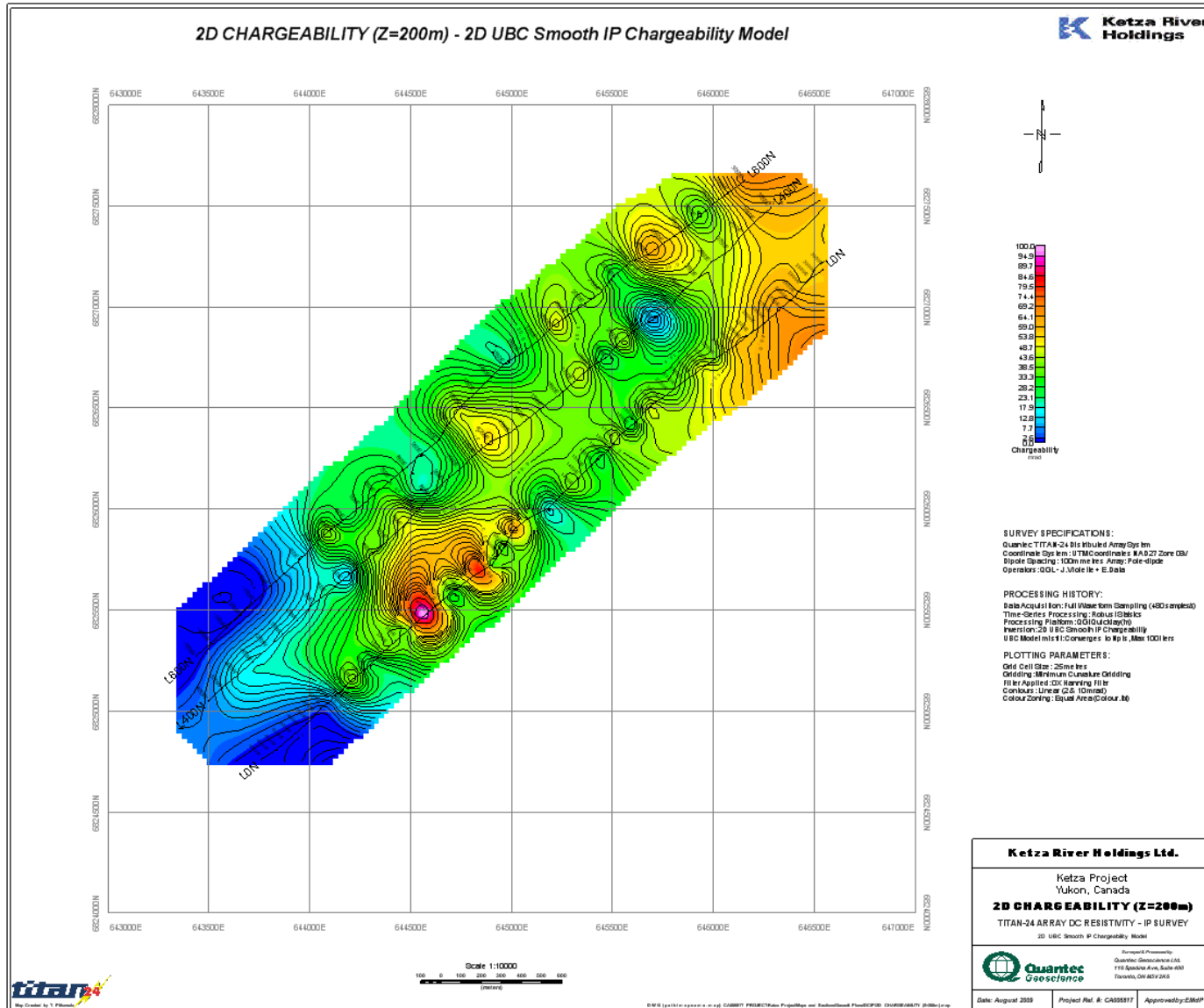


Figure III-2: 2D Smooth IP Chargeability (using Titan Conductivity) Plan Map at 200m depth “200m\_smlP”

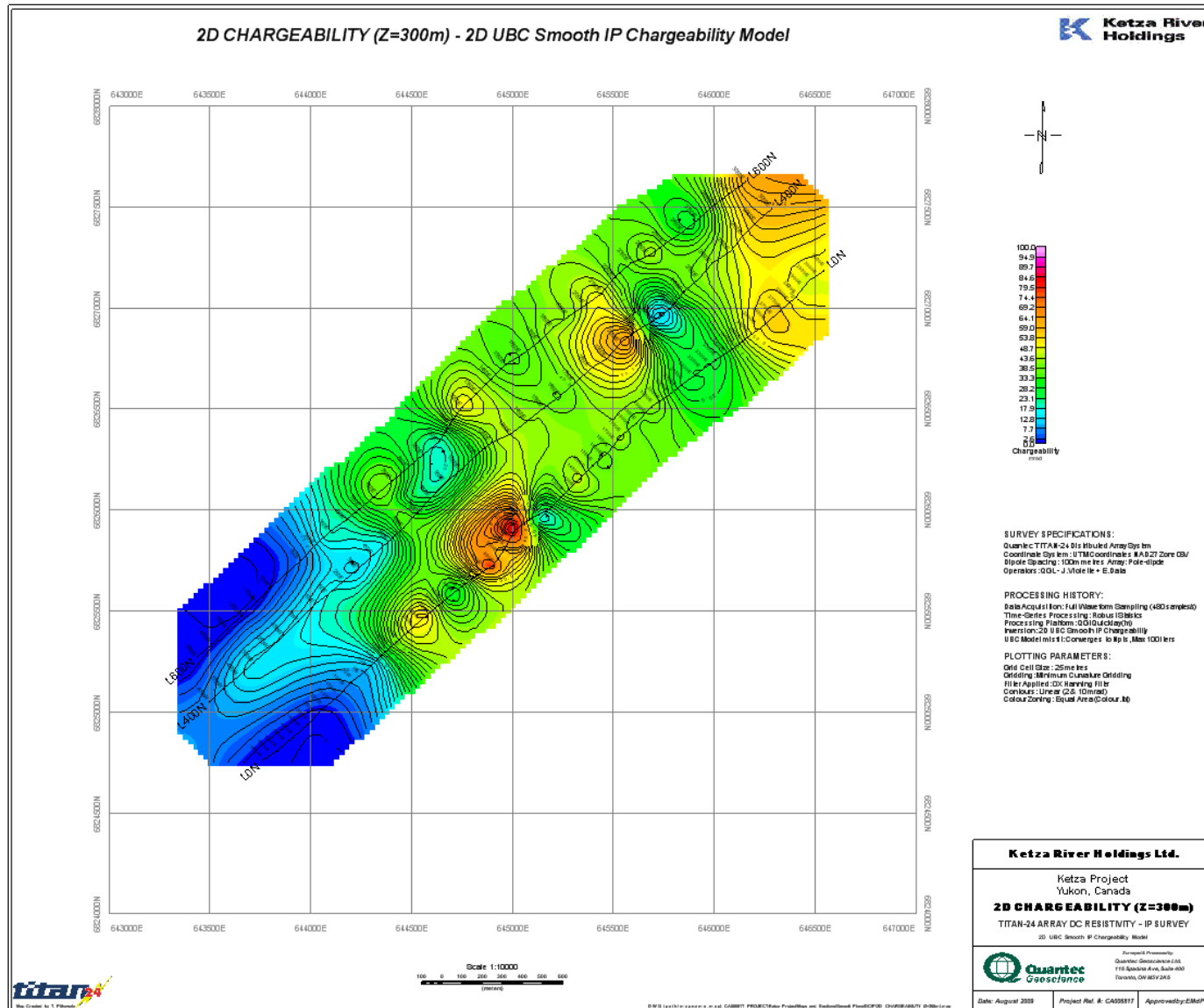


Figure III-3: 2D Smooth IP Chargeability (using Titan Conductivity) Plan Map at 300m depth “300m\_smlP”

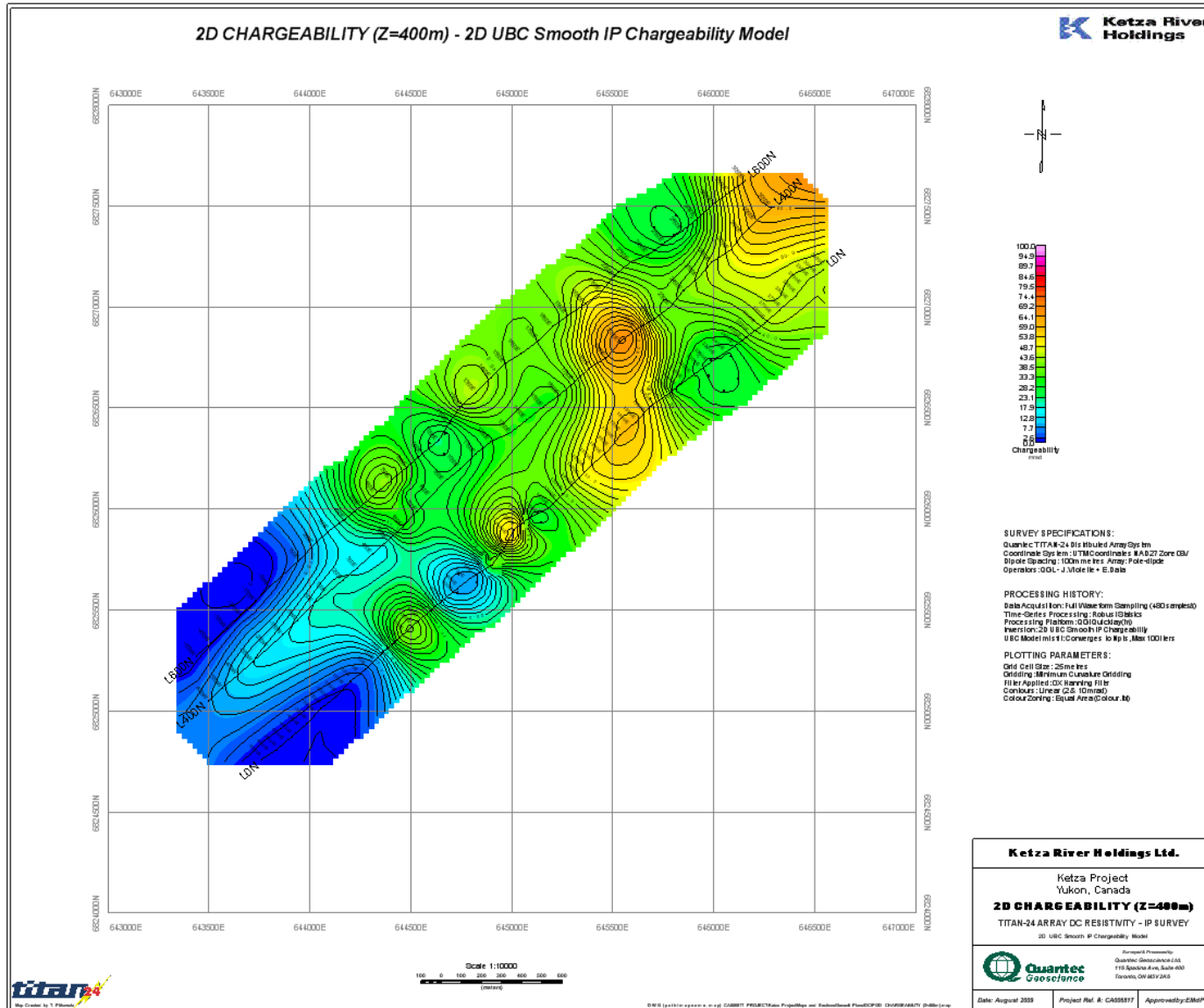


Figure III-4: 2D Smooth IP Chargeability (using Titan Conductivity) Plan Map at 400m depth “400m\_smlP”

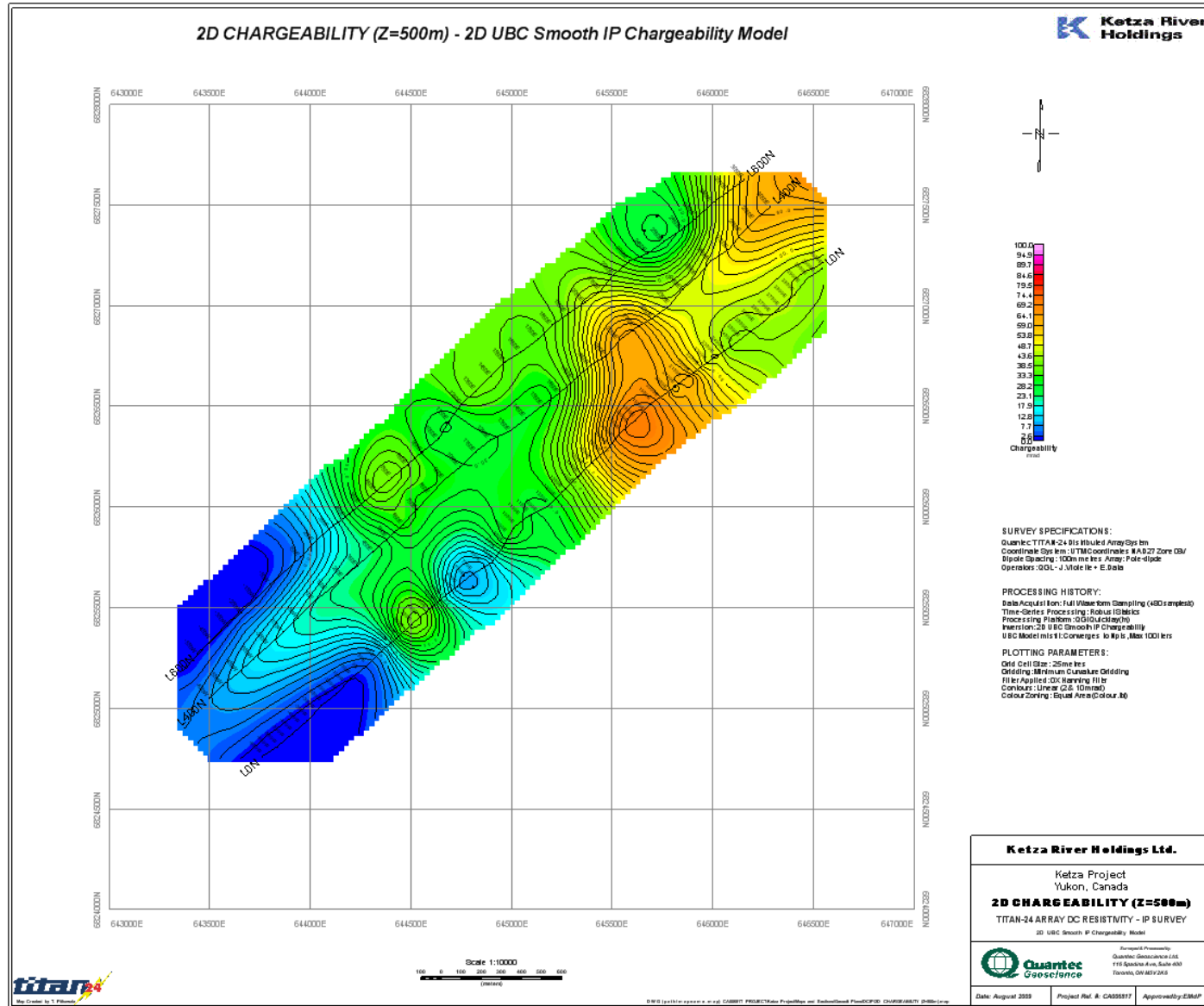


Figure III-5: 2D Smooth IP Chargeability (using Titan Conductivity) Plan Map at 500m depth "500m\_smIP"

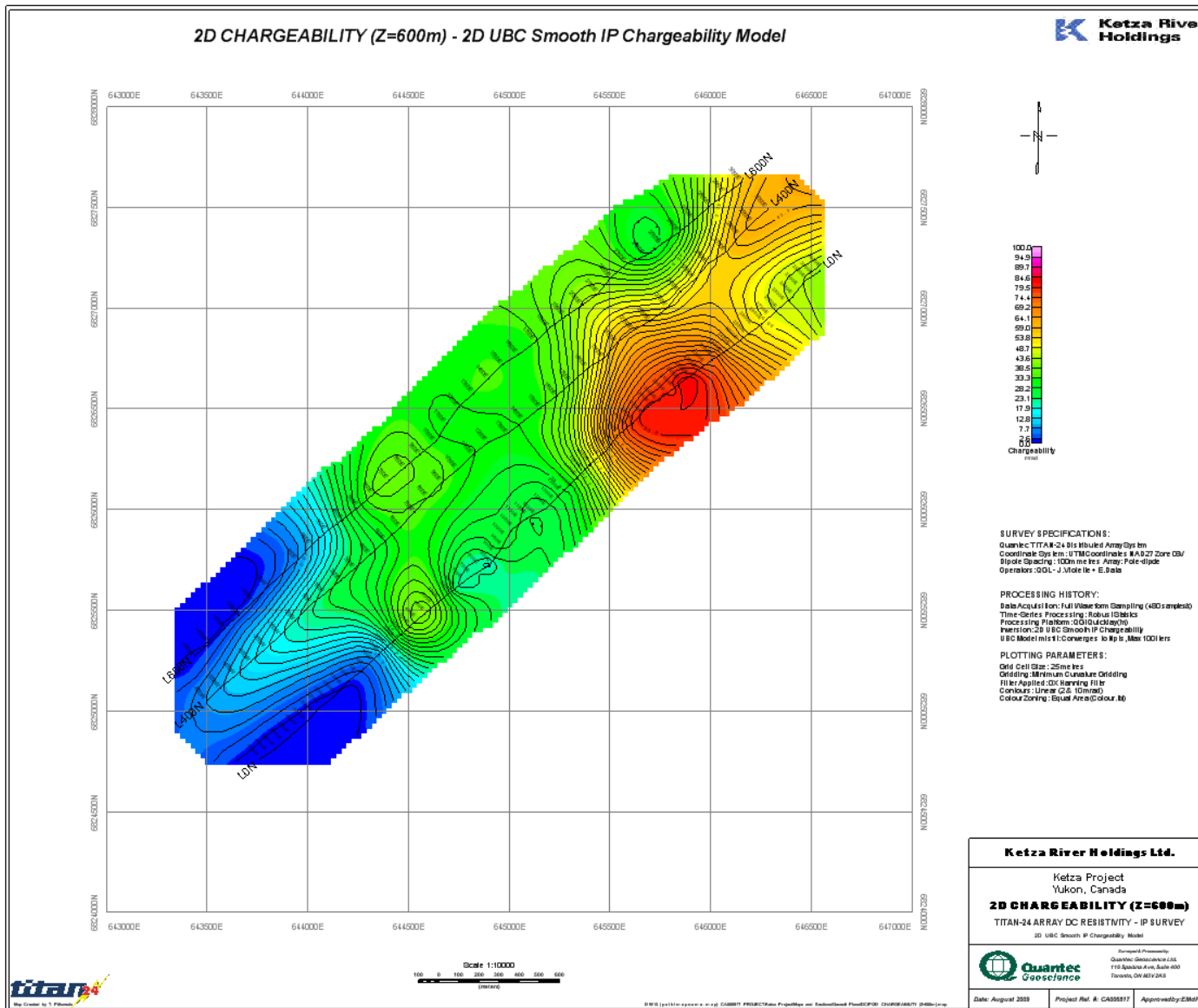


Figure III-6: 2D Smooth IP Chargeability (using Titan Conductivity) Plan Map at 600m depth "600m\_smIP"

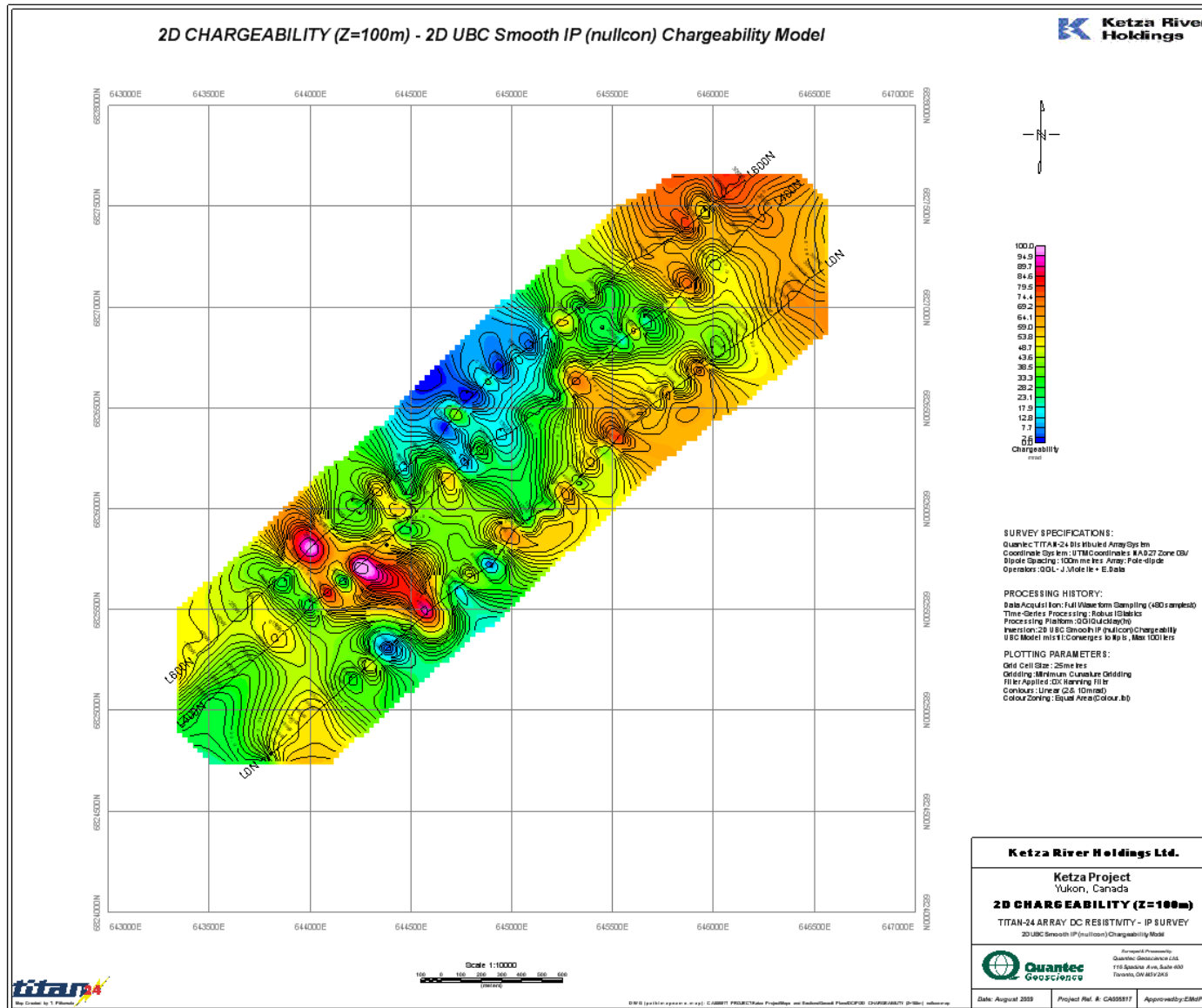


Figure III-7: 2D Smooth IP Nullcon Chargeability Plan Map at 100m depth "100m\_nullIP"

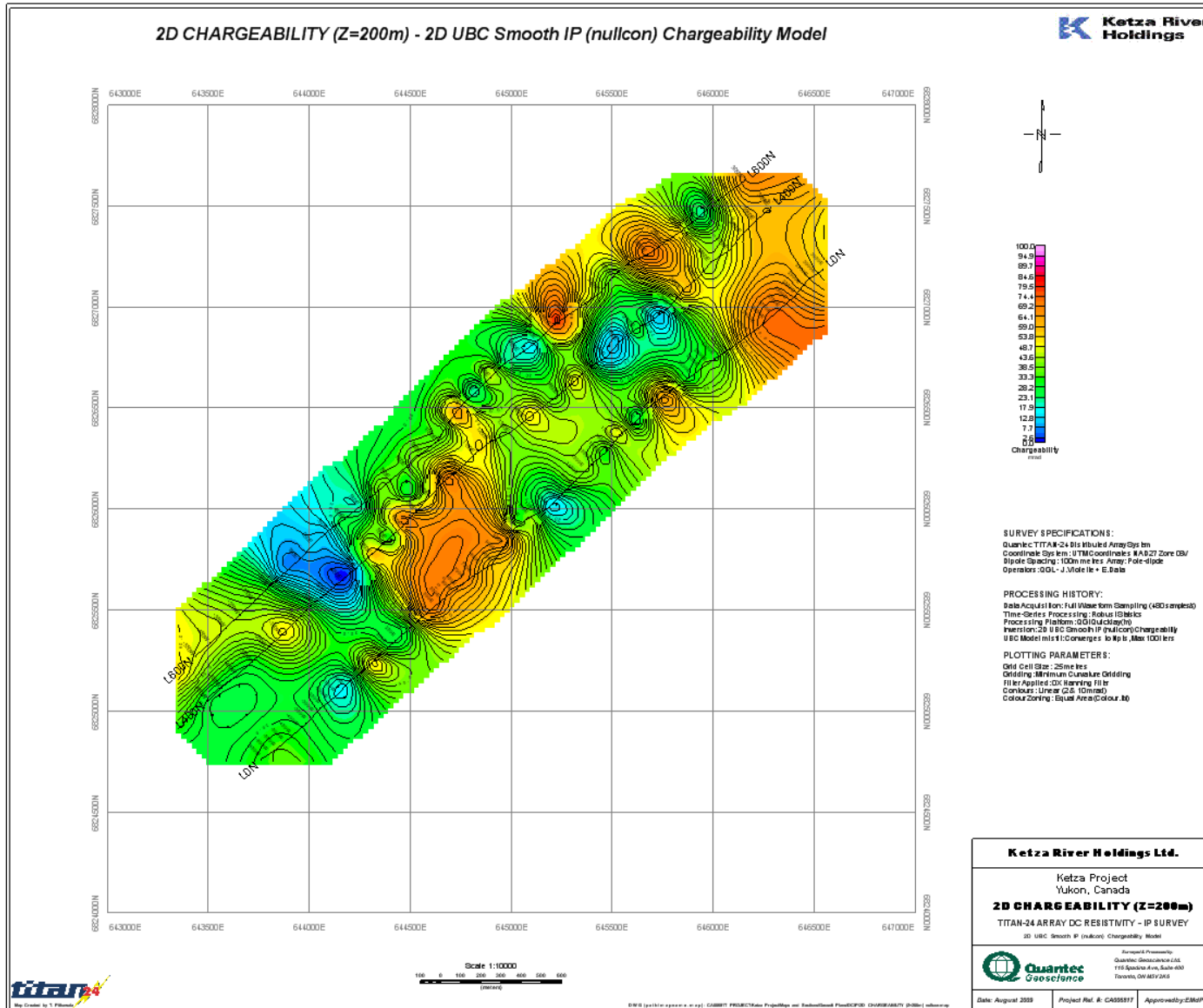


Figure III-8: 2D Smooth IP Nullcon Chargeability Plan Map at 200m depth "200m\_nullIP"

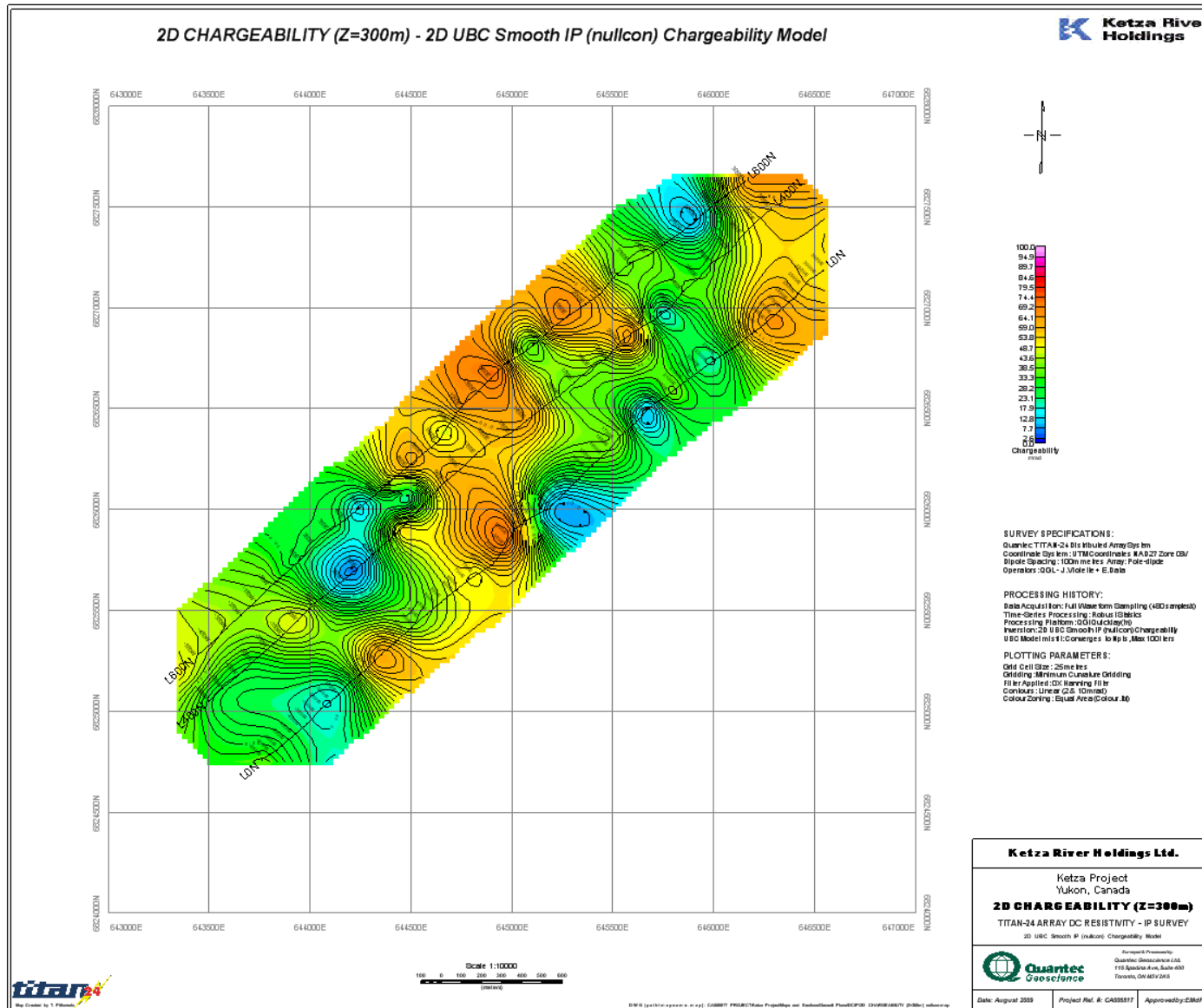


Figure III-9: 2D Smooth IP Nullcon Chargeability Plan Map at 300m depth "300m\_nullIP"

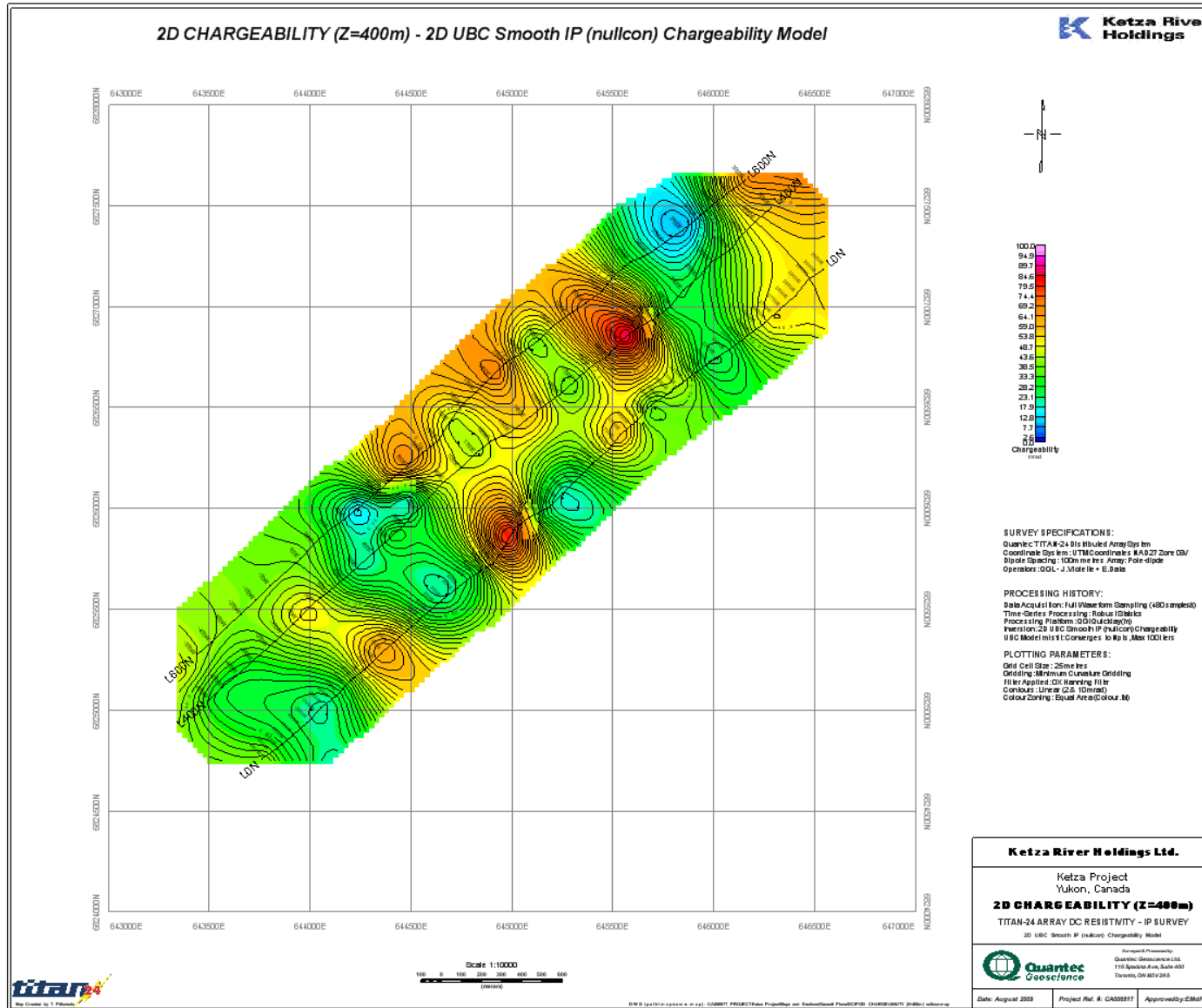


Figure III-10: 2D Smooth IP Nullcon Chargeability Plan Map at 400m depth "400m\_nullIP"

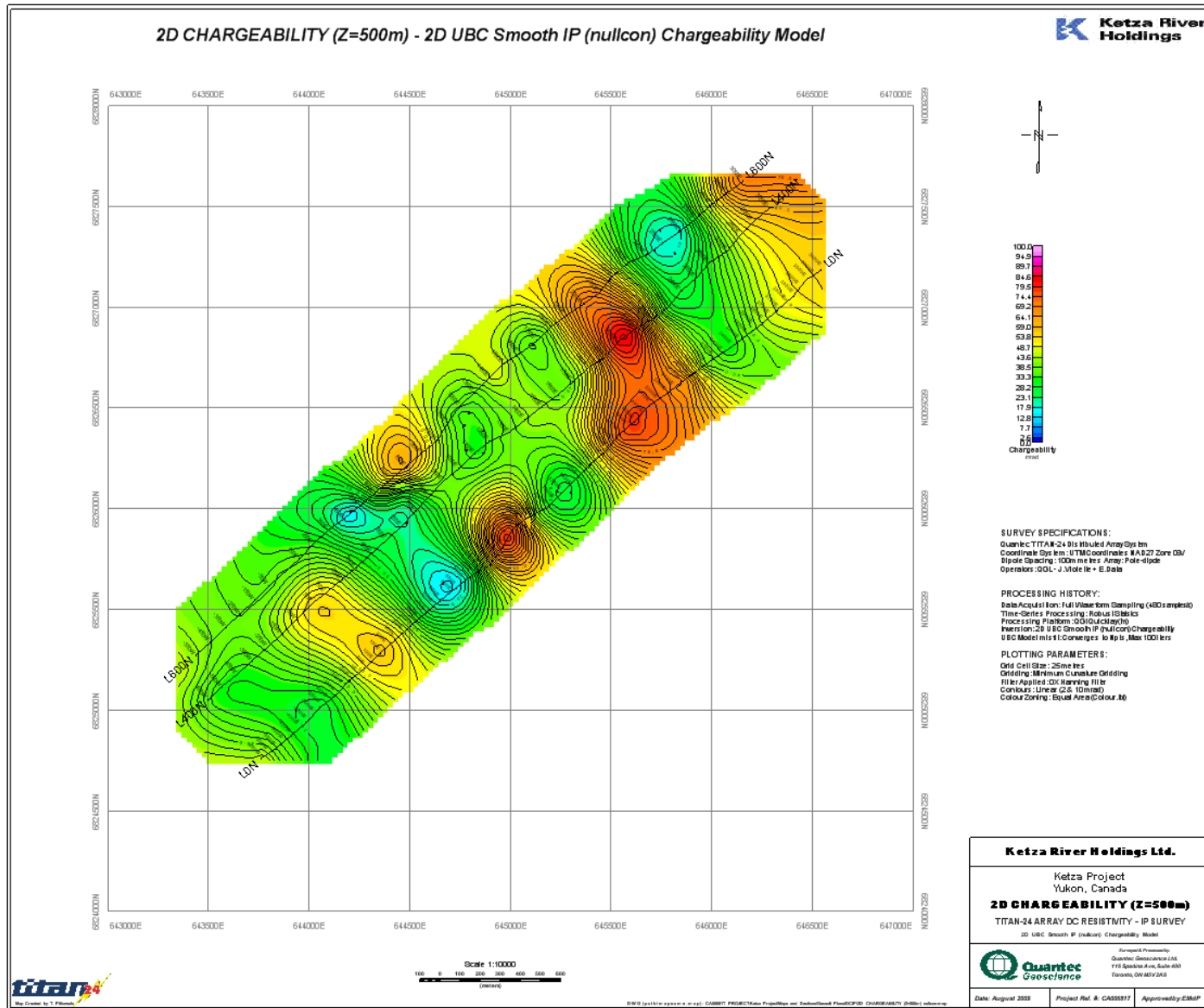


Figure III-11: 2D Smooth IP Nullcon Chargeability Plan Map at 500m depth "500m\_nullIP"

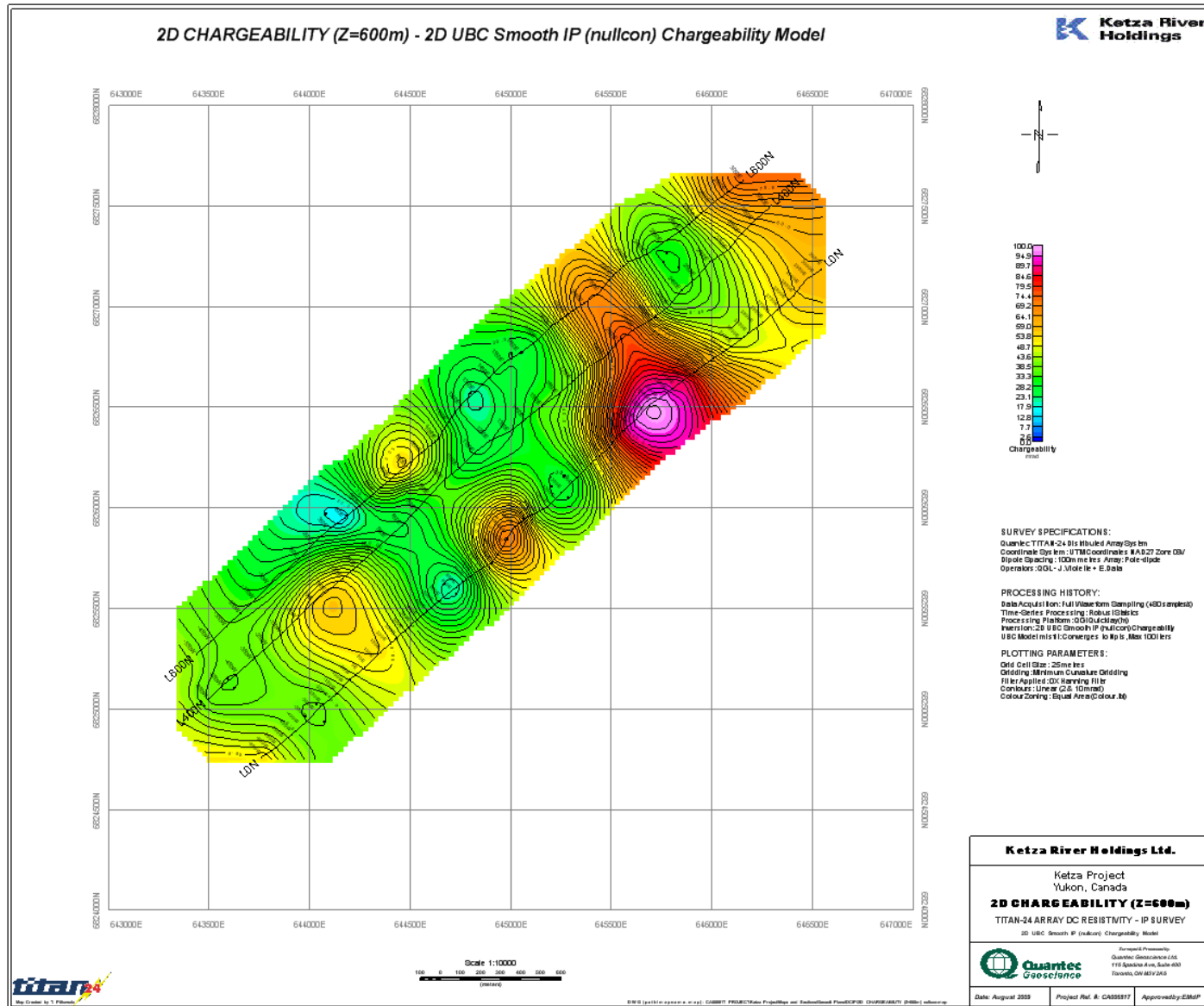


Figure III-12: 2D Smooth IP Nullcon Chargeability Plan Map at 600m depth "600m\_nullIP"



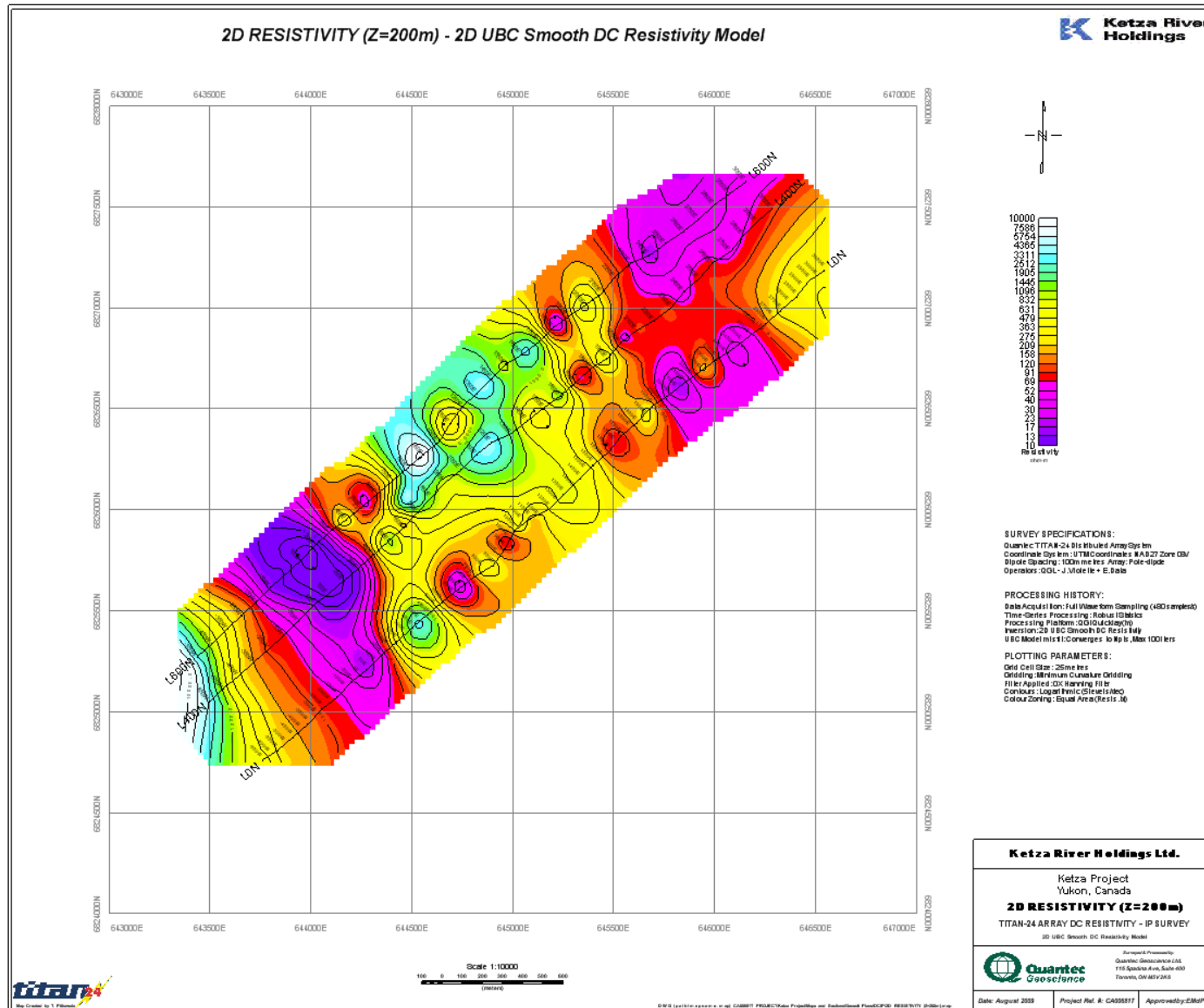


Figure III-14: 2D Smooth DC Resistivity Plan Map at 200m depth "200m\_smDC"

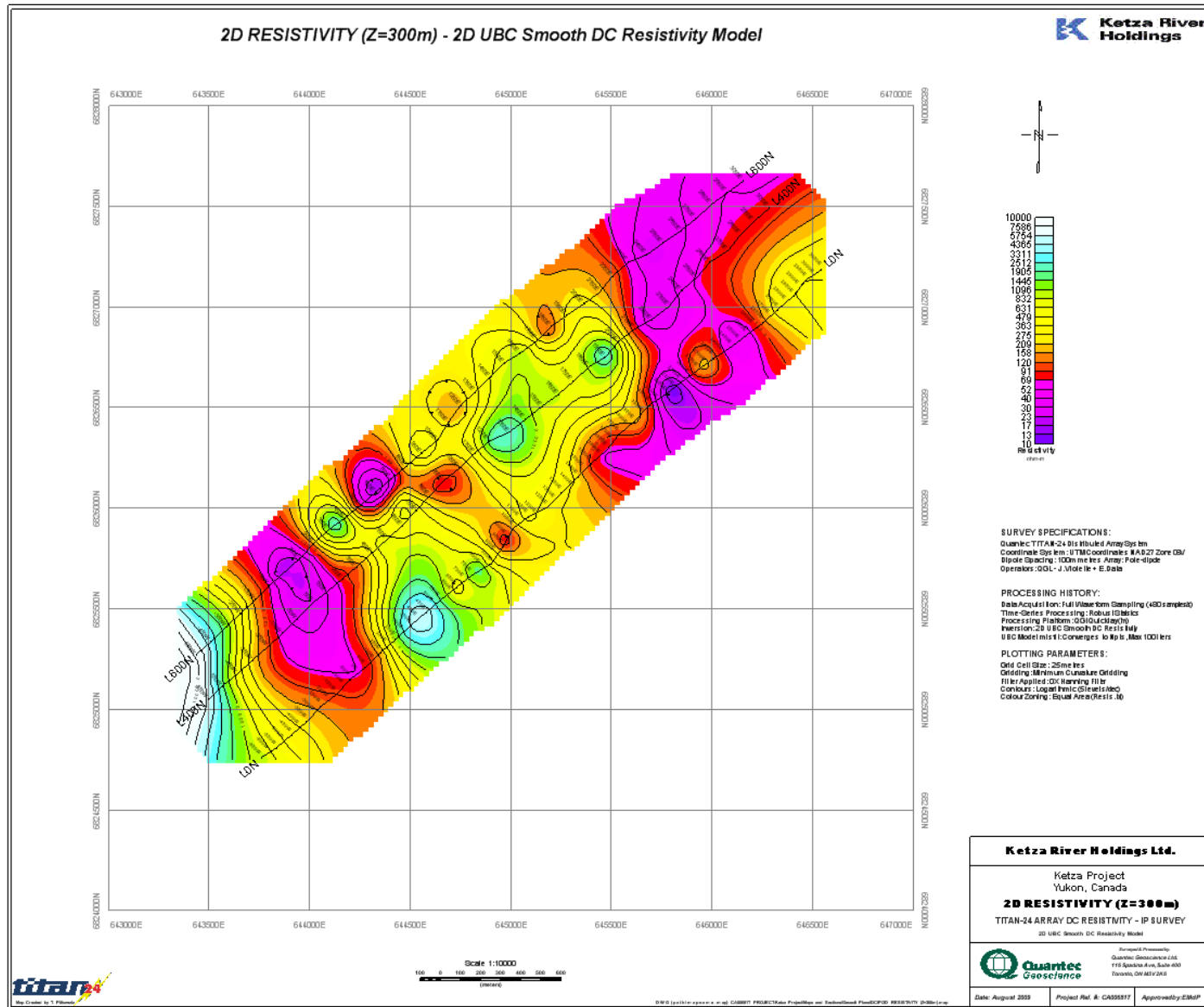


Figure III-15: 2D Smooth DC Resistivity Plan Map at 300m depth "300m\_smDC"

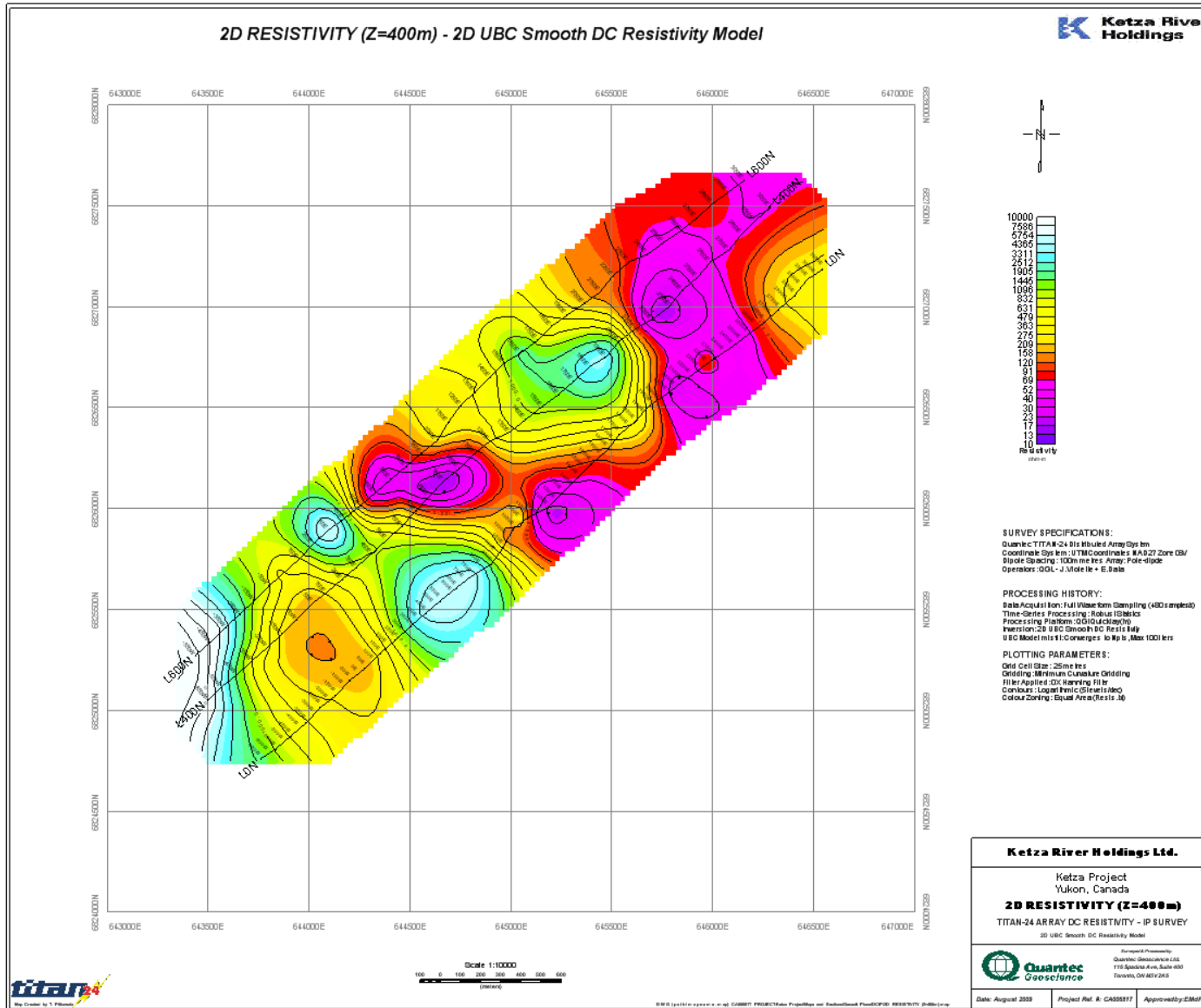


Figure III-16: 2D Smooth DC Resistivity Plan Map at 400m depth "400m\_smDC"





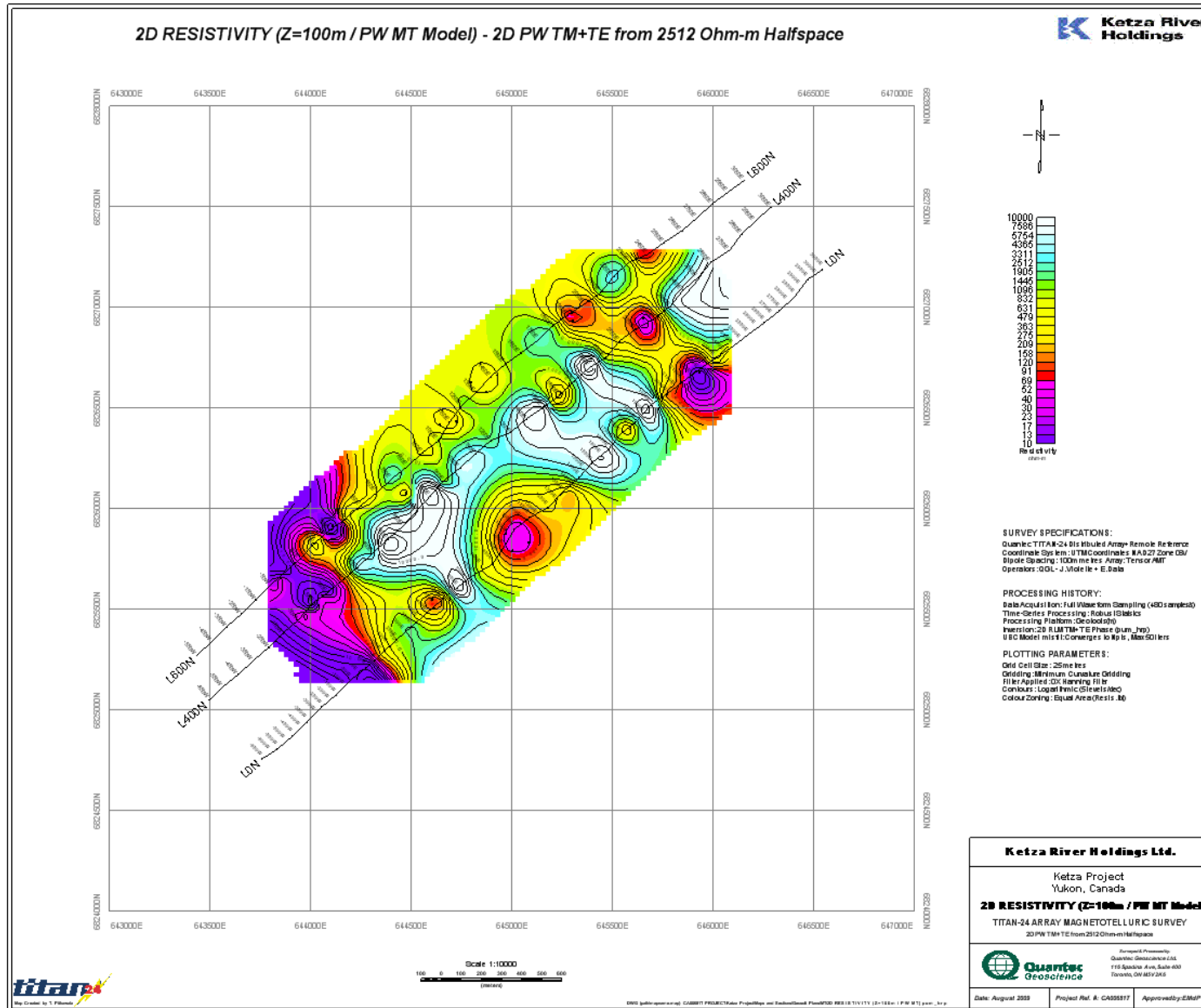


Figure III-19: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 100m depth "100m\_pum\_hrp"



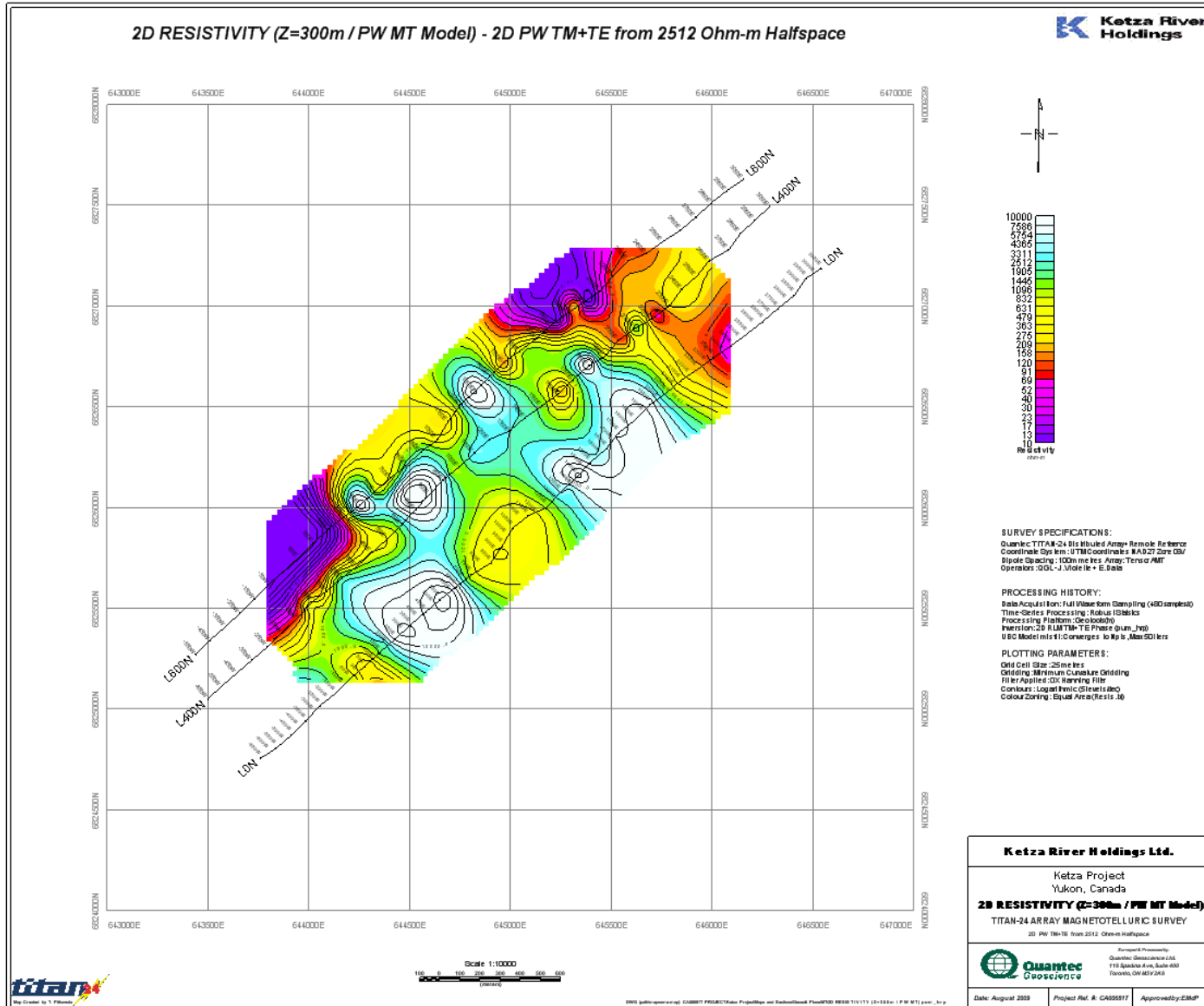


Figure III-21: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 300m depth "300m\_pum\_hrp"

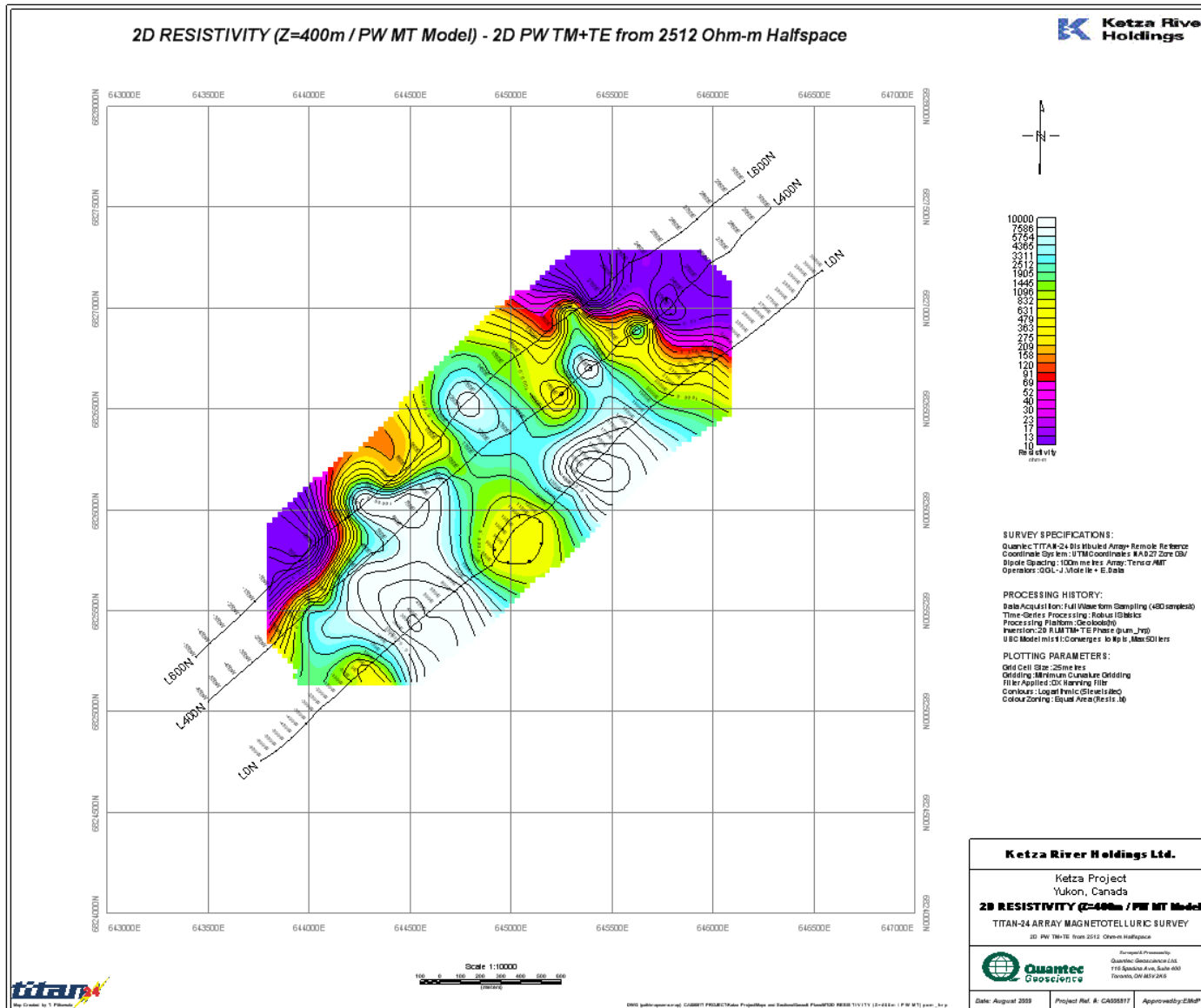


Figure III-22: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 400m depth "400m\_pum\_hrp"

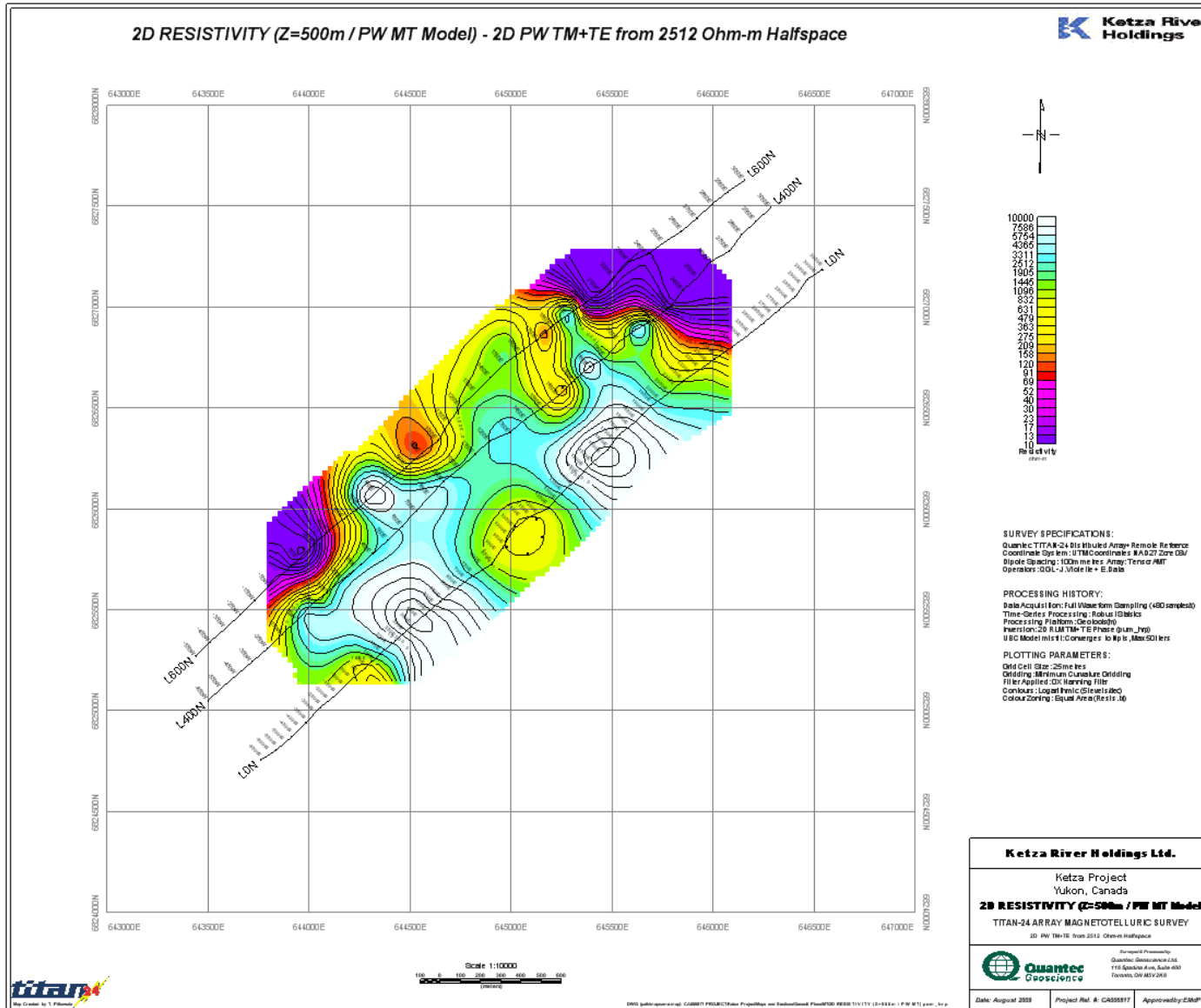


Figure III-23: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 500m depth "500m\_pum\_hrp"

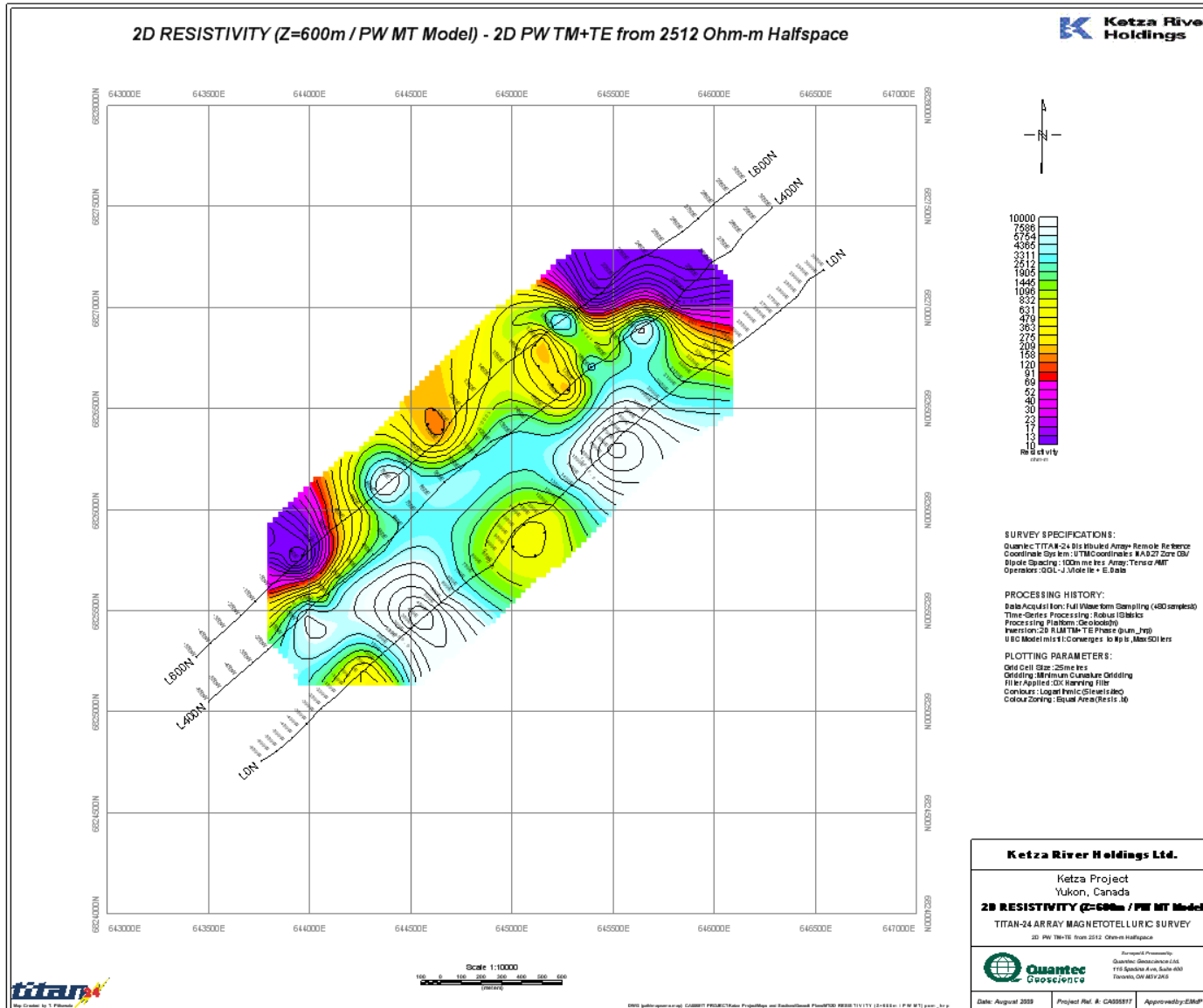


Figure III-24: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 600m depth "600m\_pum\_hrp"

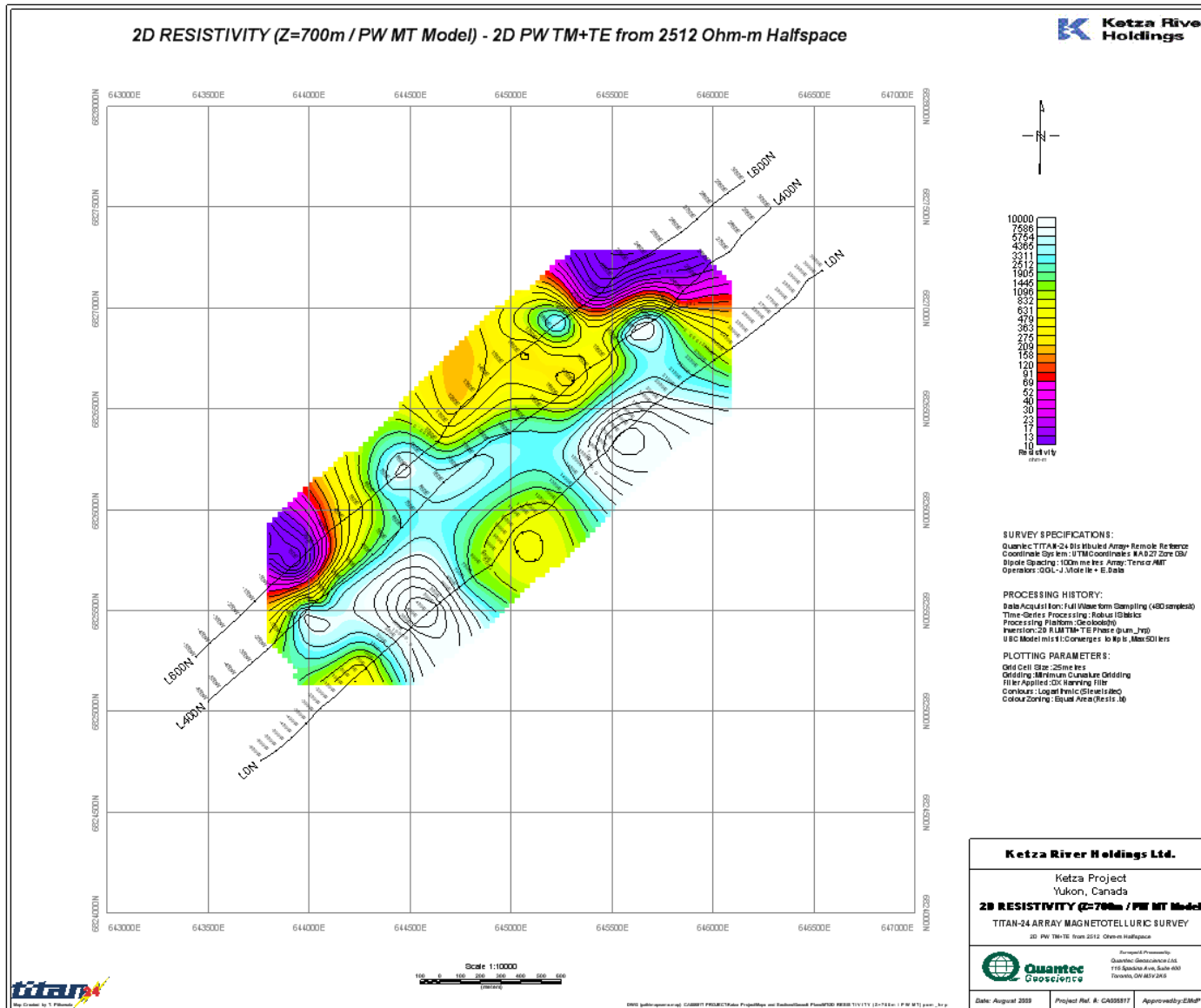


Figure III-25: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 700m depth "700m\_pum\_hrp"

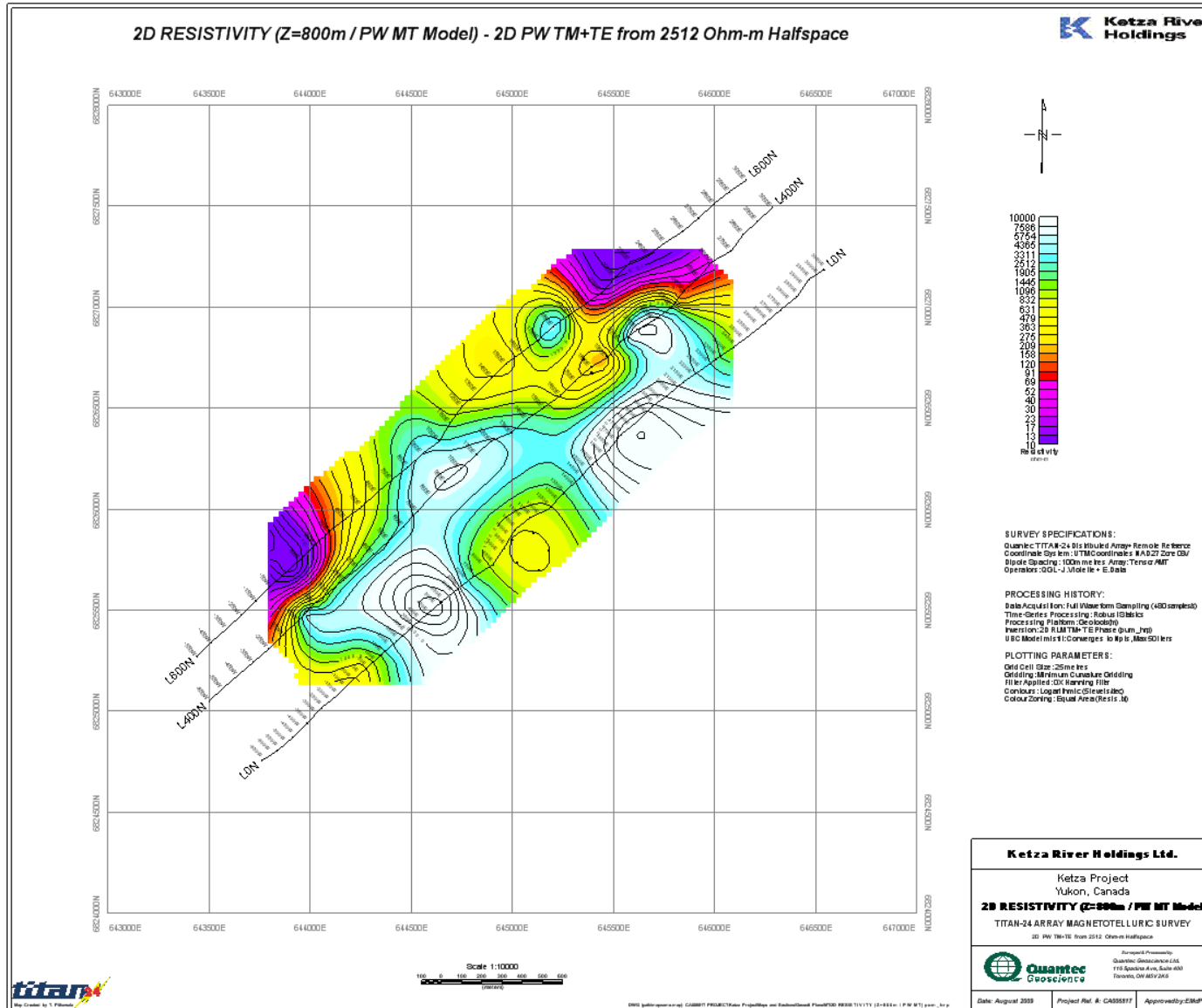


Figure III-26: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 800m depth "800m\_pum\_hrp"

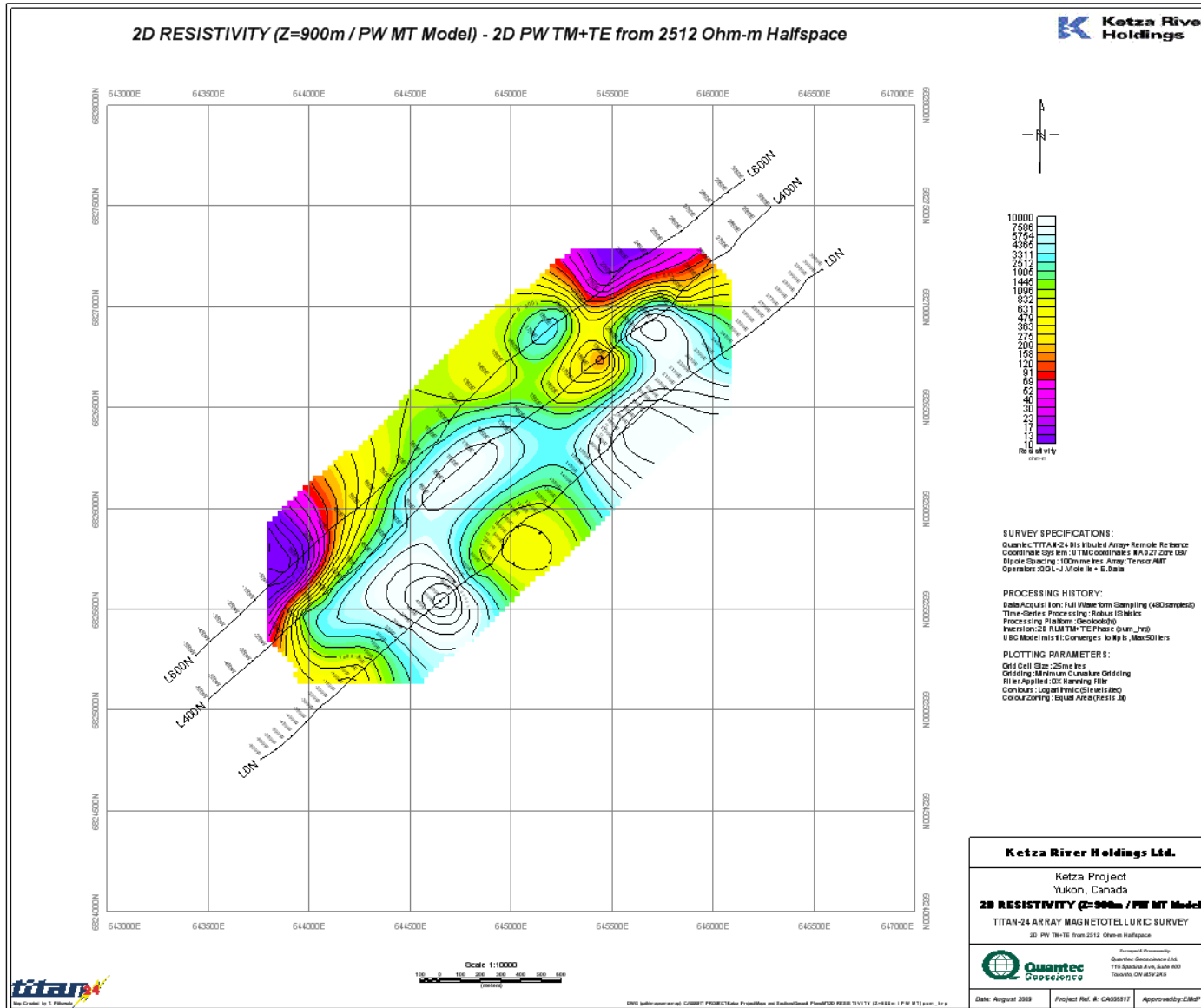


Figure III-27: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 900m depth "900m\_pum\_hrp"

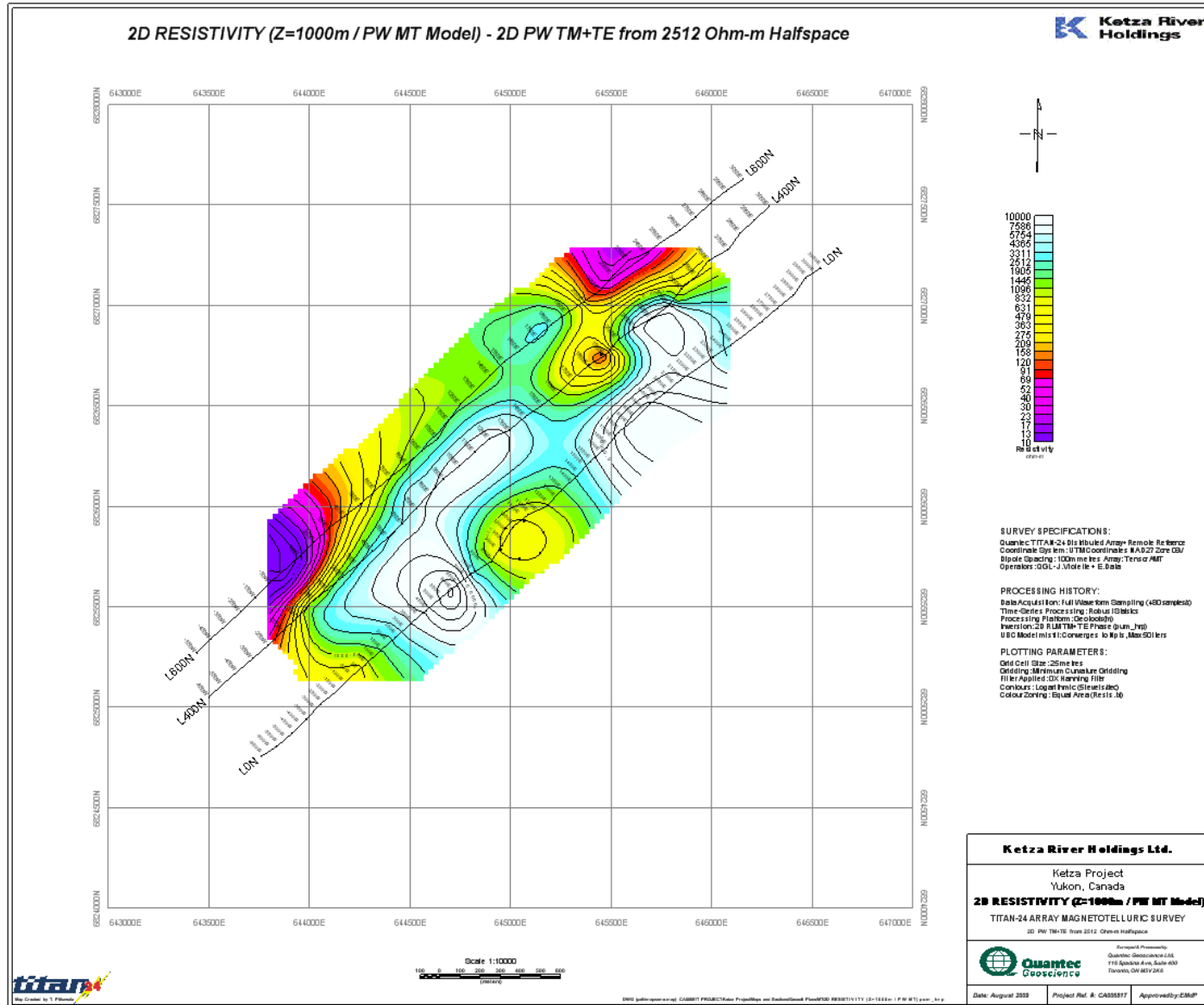


Figure III-28: 2D PW (TM phs/rho + TE phs/rho) MT Resistivity Plan Map at 1000m depth "1000m\_pum\_hrp"





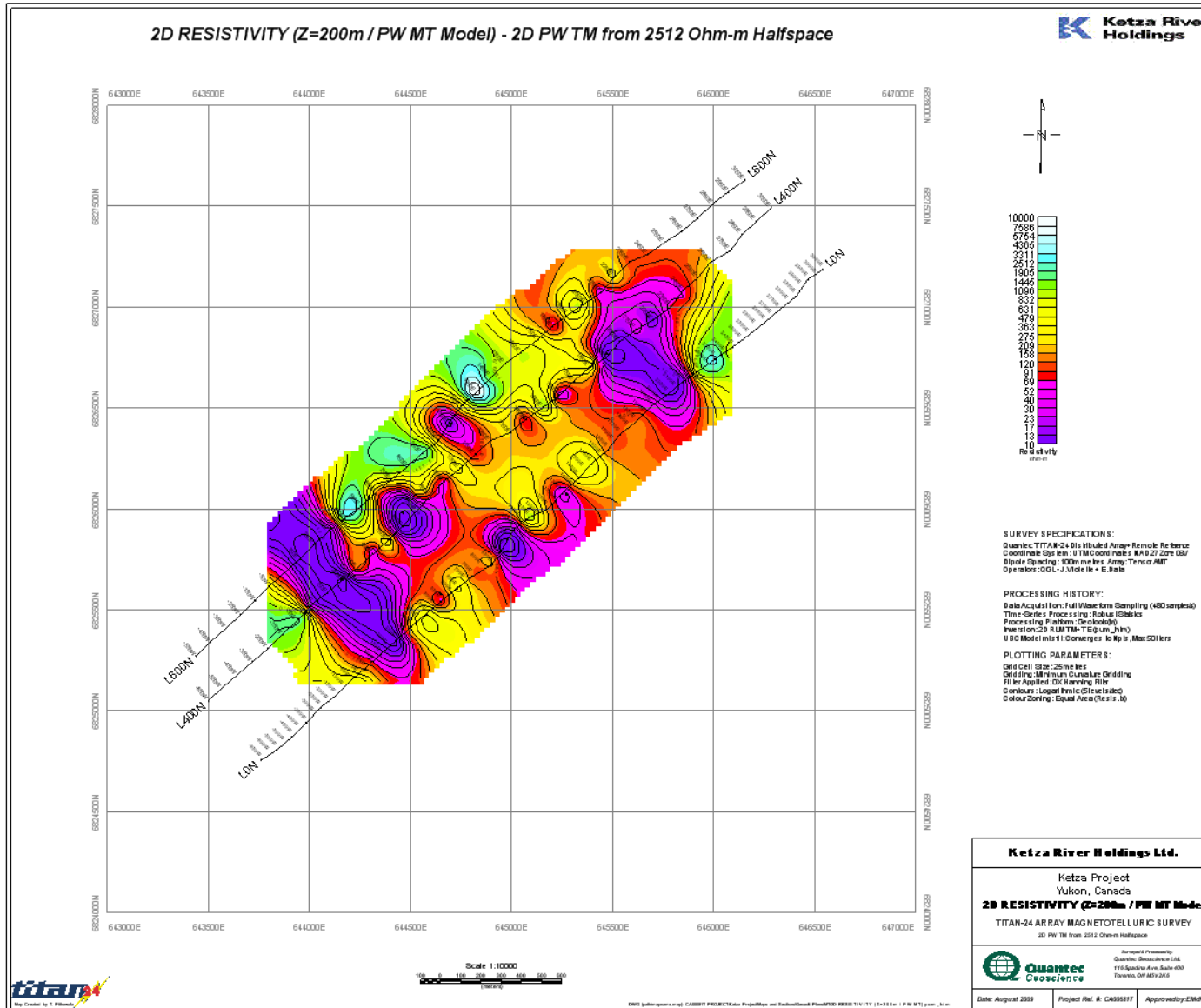


Figure III-31: 2D PW (TM phs/rho) MT Resistivity Plan Map at 200m depth "200m\_pum\_htm"

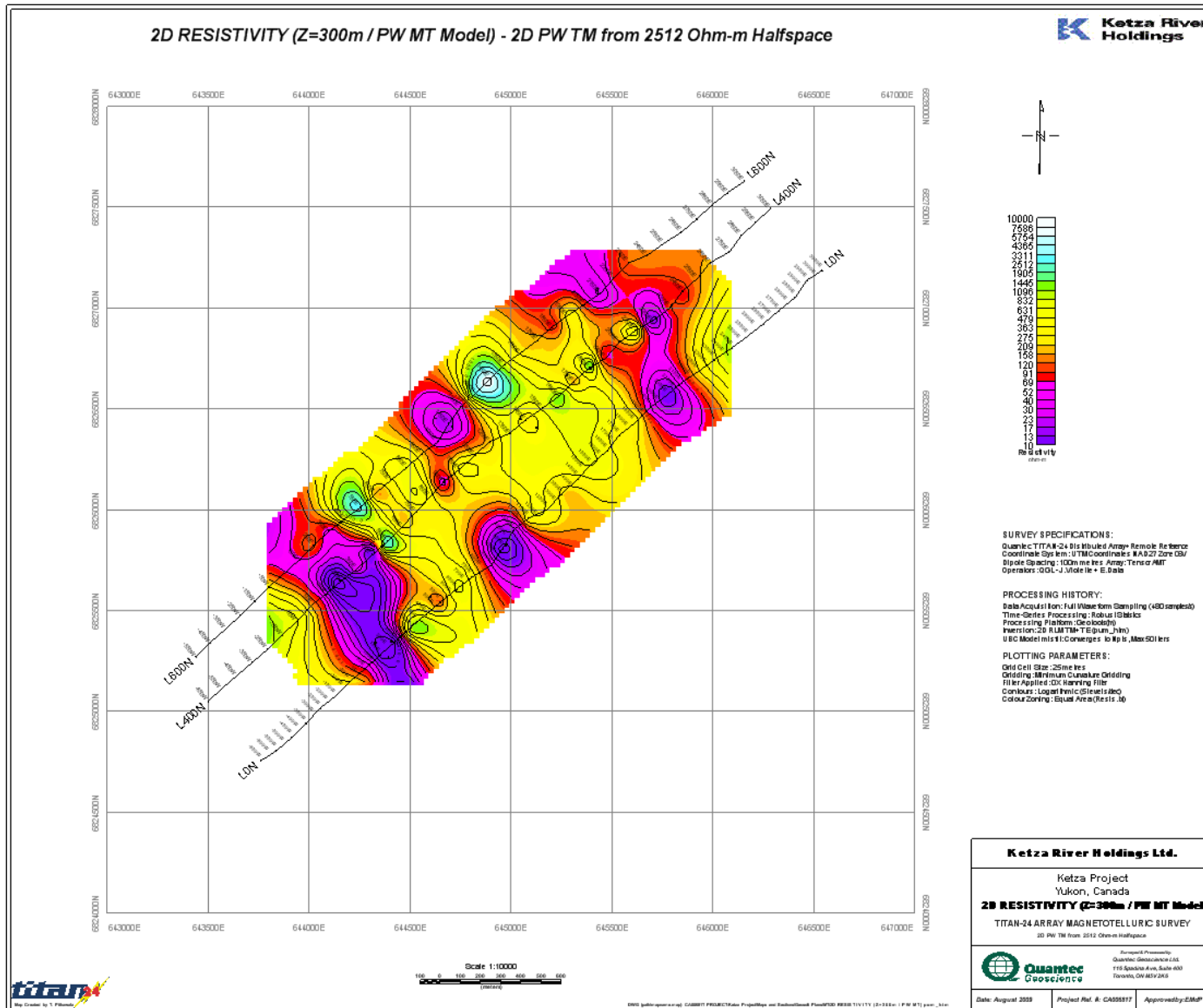


Figure III-32: 2D PW (TM phs/rho) MT Resistivity Plan Map at 300m depth "300m\_pum\_htm"



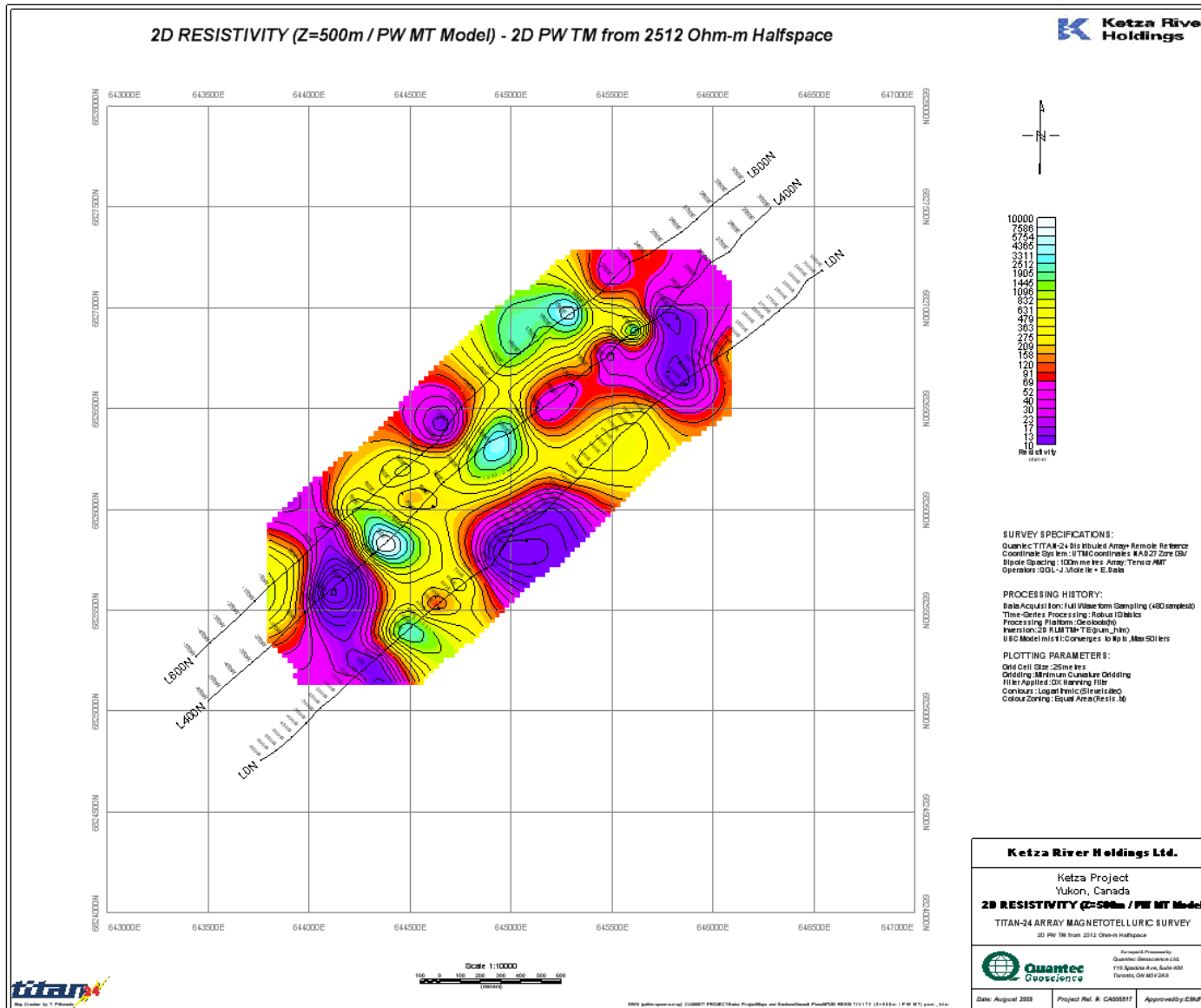


Figure III-34: 2D PW (TM phs/rho) MT Resistivity Plan Map at 500m depth "500m\_pum\_htm"

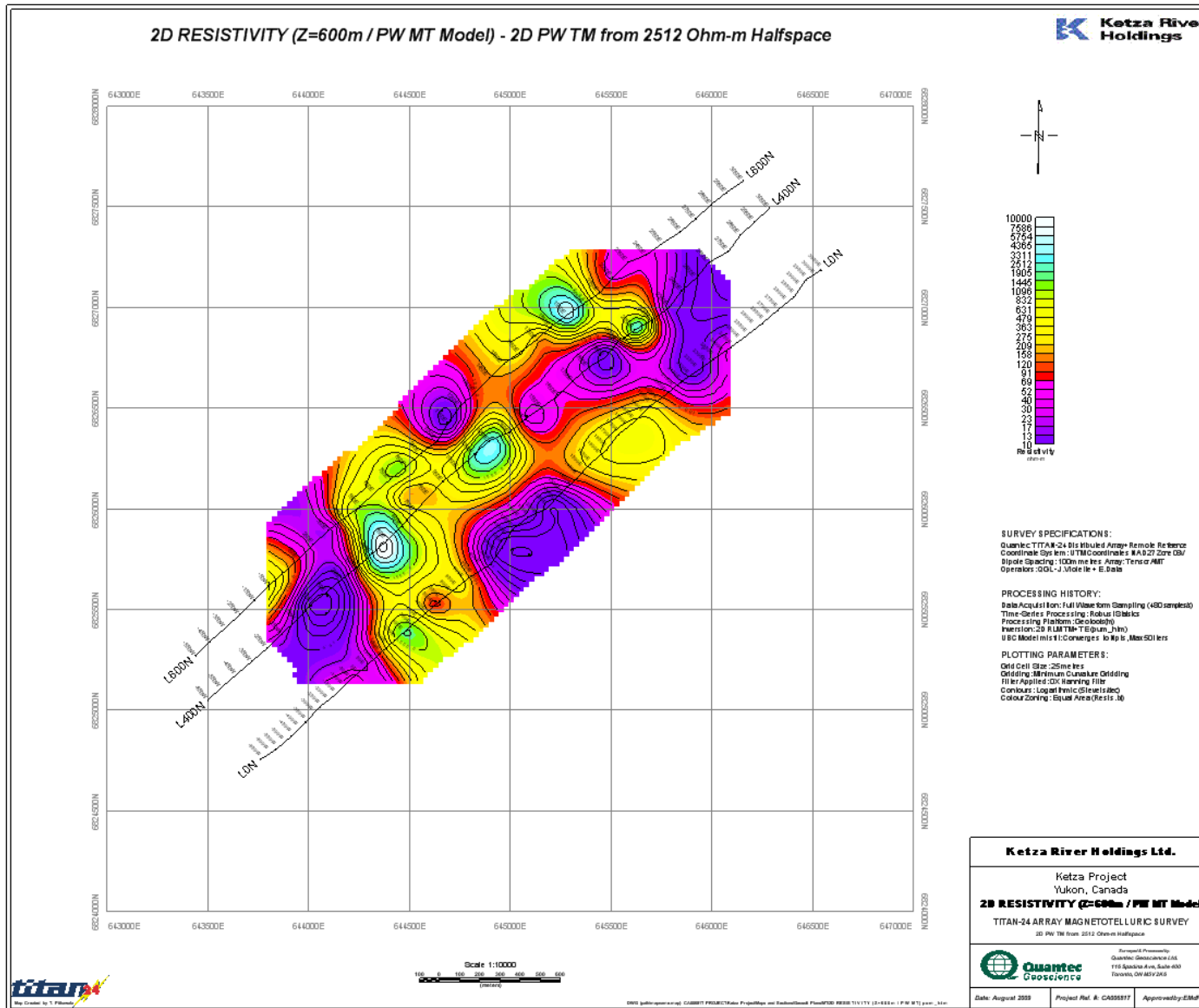


Figure III-35: 2D PW (TM phs/rho) MT Resistivity Plan Map at 600m depth "600m\_pum\_htm"

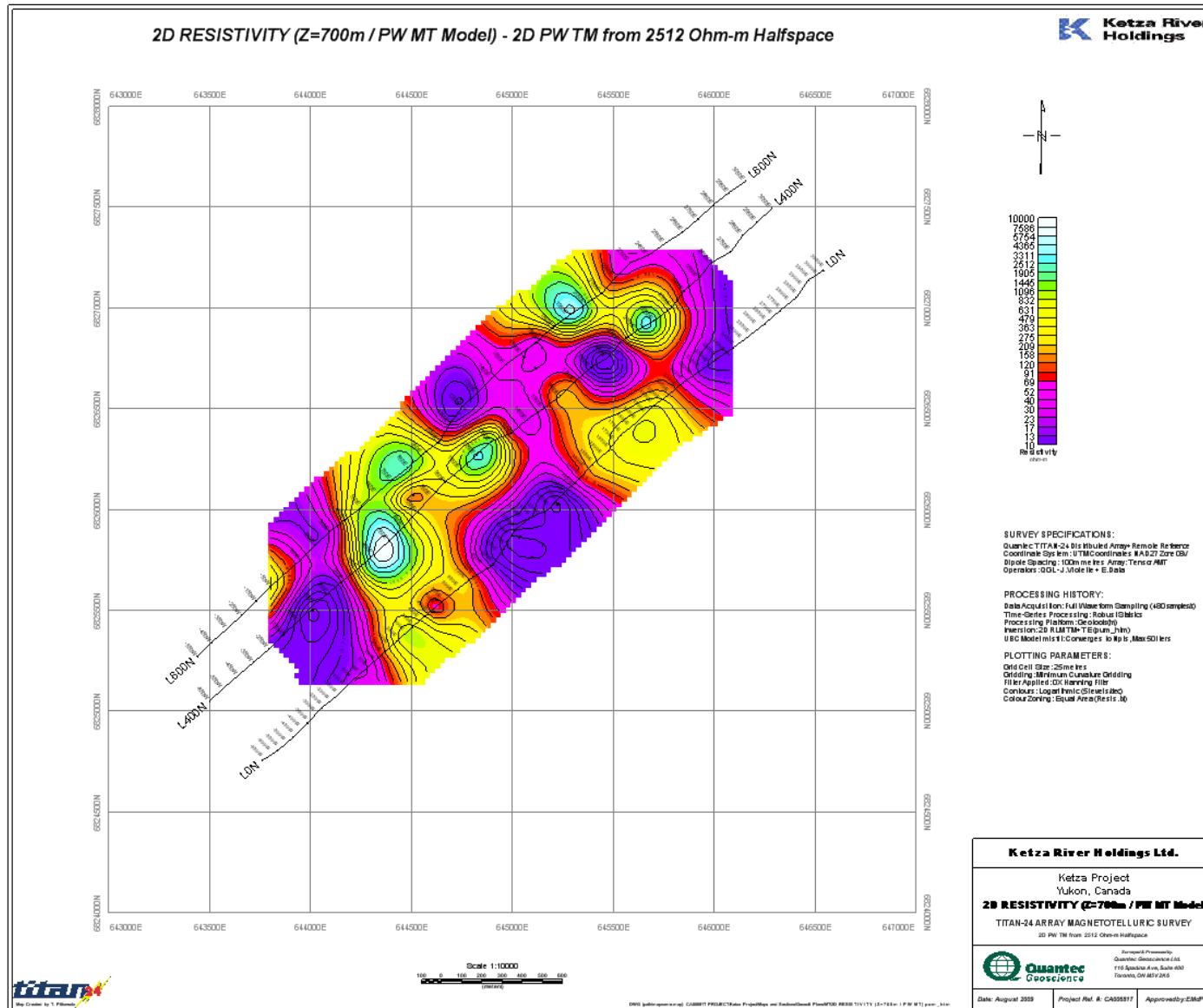


Figure III-36: 2D PW (TM phs/rho) MT Resistivity Plan Map at 700m depth "700m\_pum\_htm"

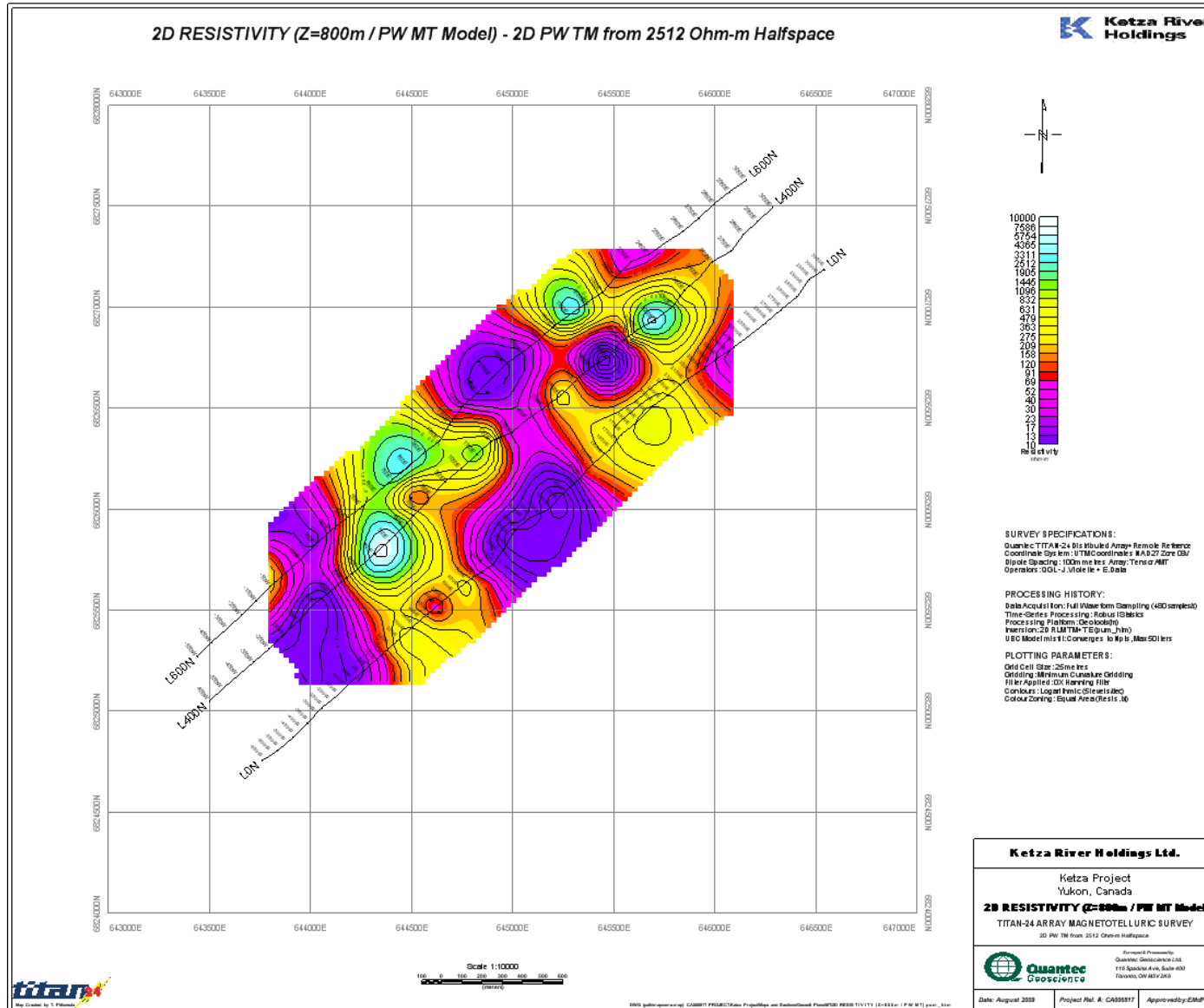


Figure III-37: 2D PW (TM phs/rho) MT Resistivity Plan Map at 800m depth "800m\_pum\_hm"

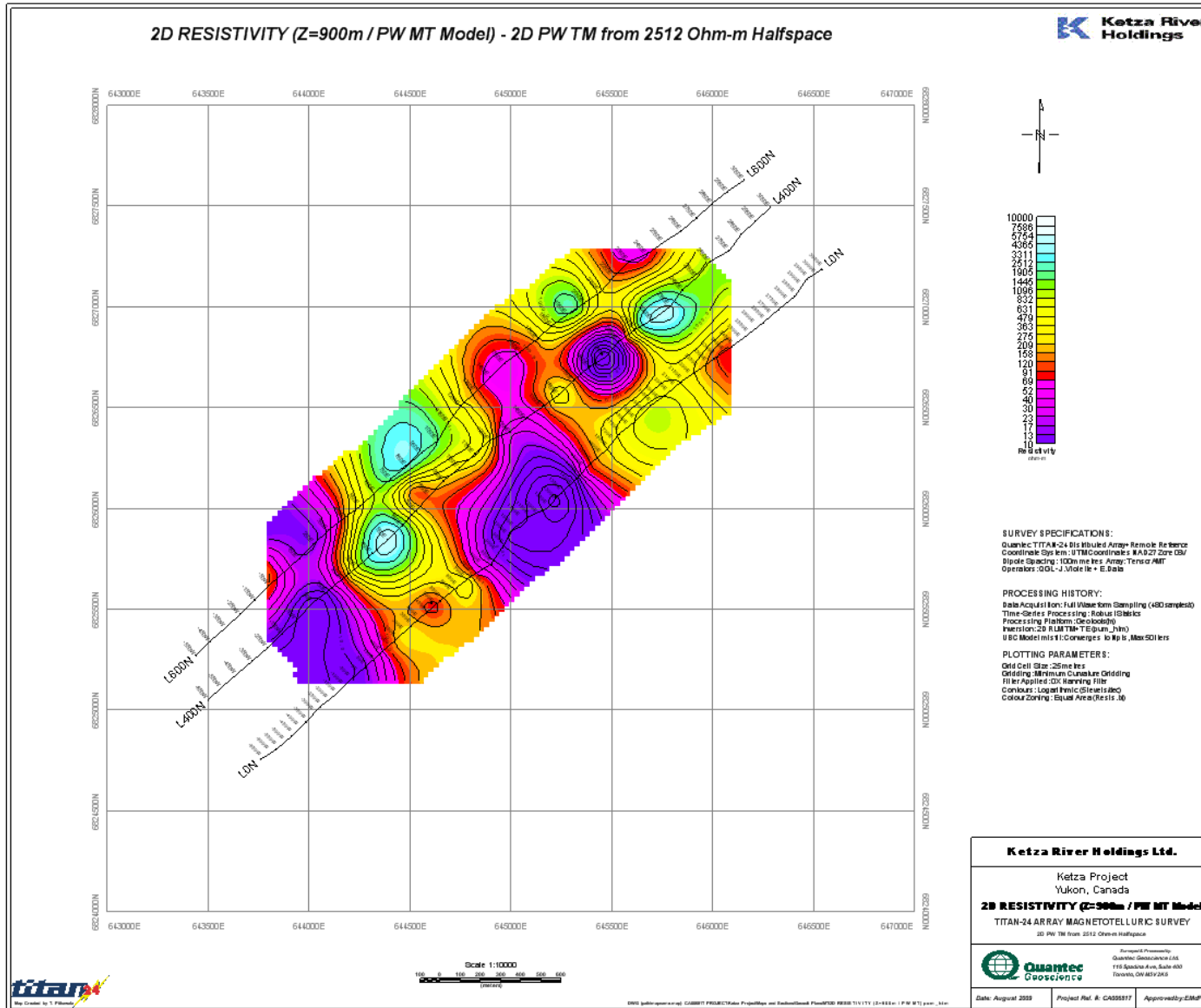


Figure III-38: 2D PW (TM phs/rho) MT Resistivity Plan Map at 900m depth "900m\_pum\_htm"

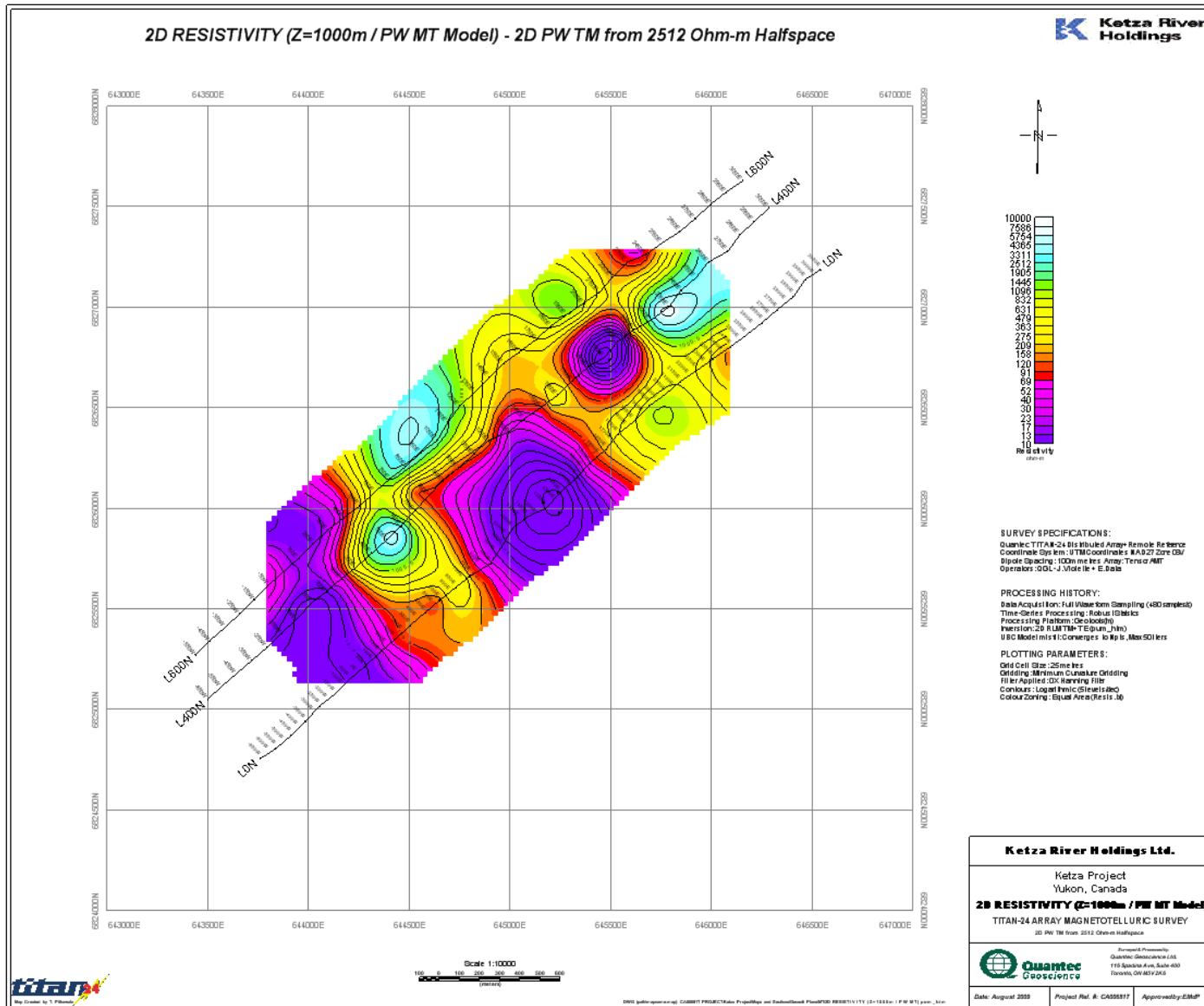


Figure III-39: 2D PW (TM phs/rho) MT Resistivity Plan Map at 1000m depth "1000m\_pum\_htm"

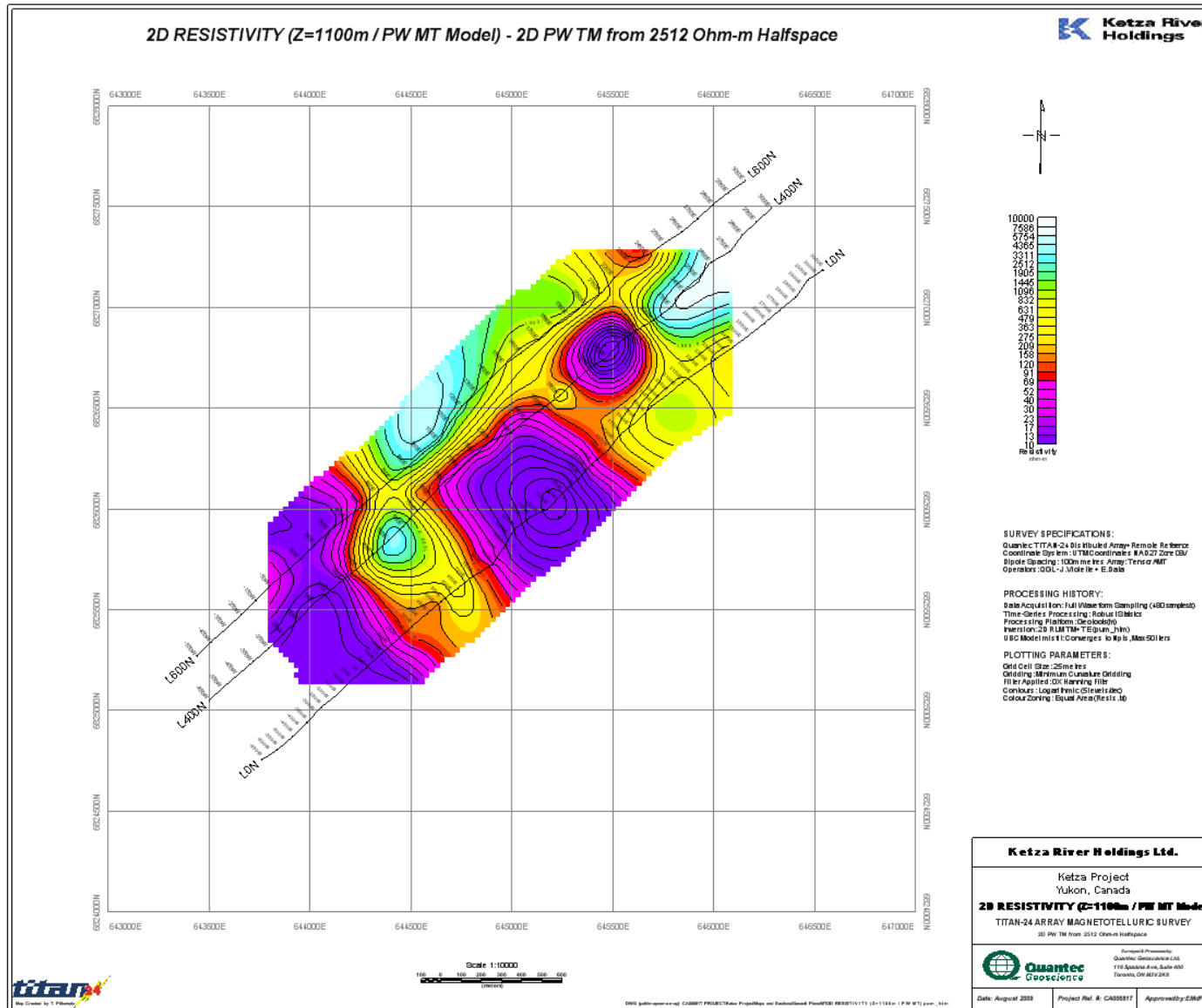


Figure III-40: 2D PW (TM phs/rho) MT Resistivity Plan Map at 1000m depth "1200m\_pum\_htm"



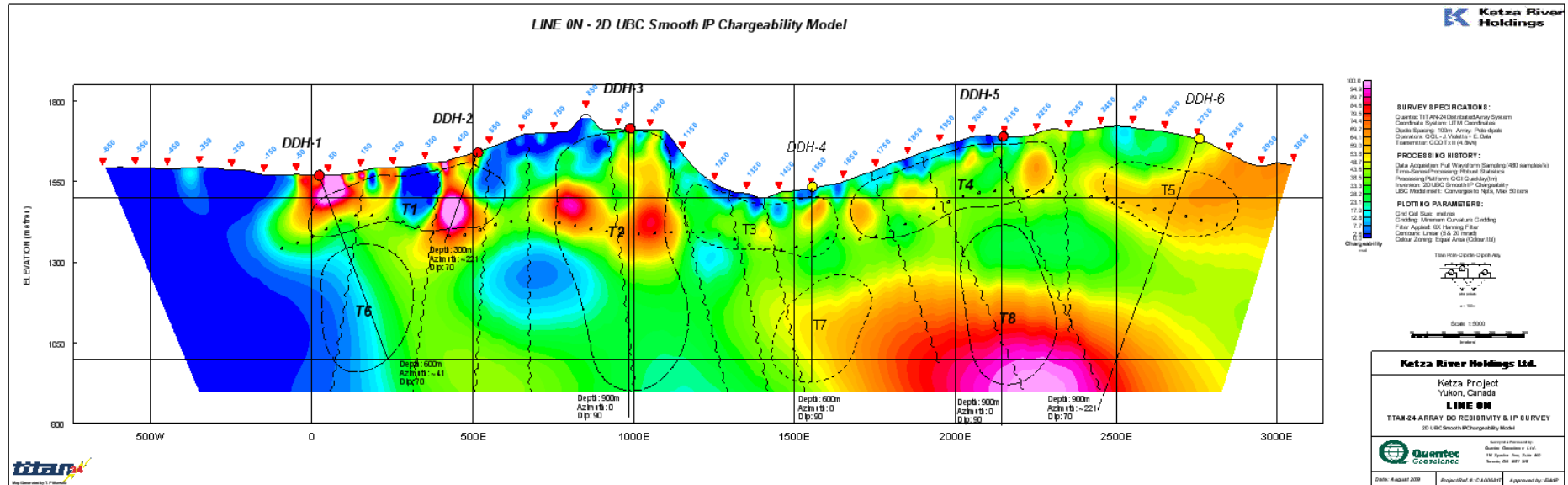


Figure IV-2: Line L0N Interpretation Section over 2D Smooth Chargeability

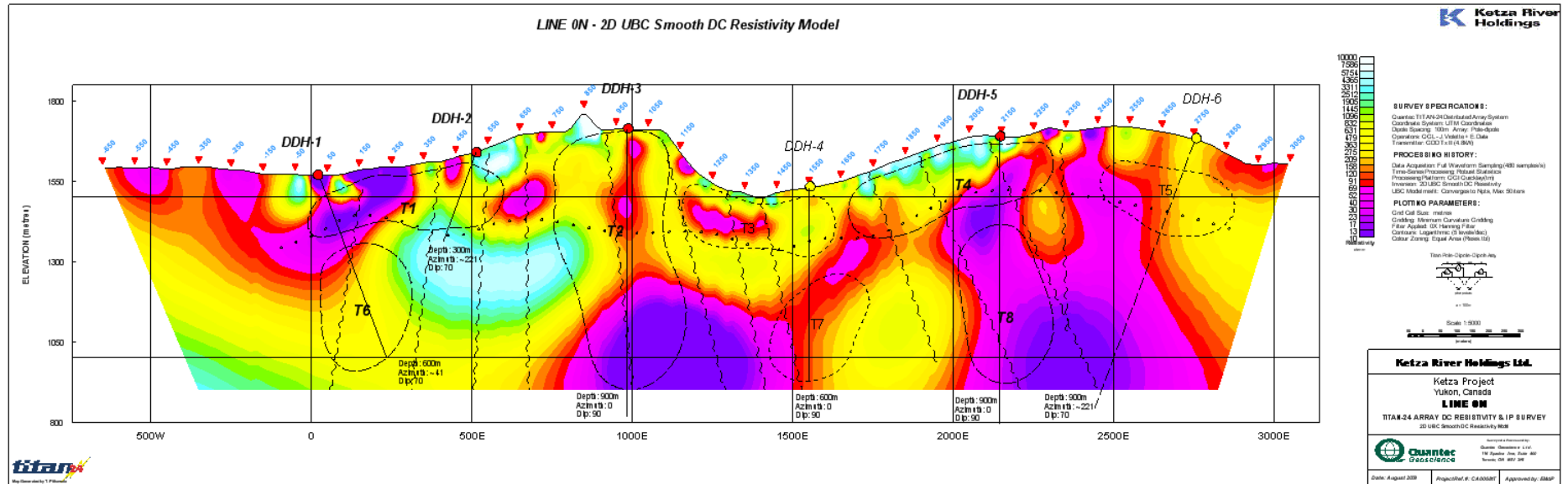


Figure IV-3: Line L0N Interpretation Section over 2D Smooth DC Resistivity (smDC)

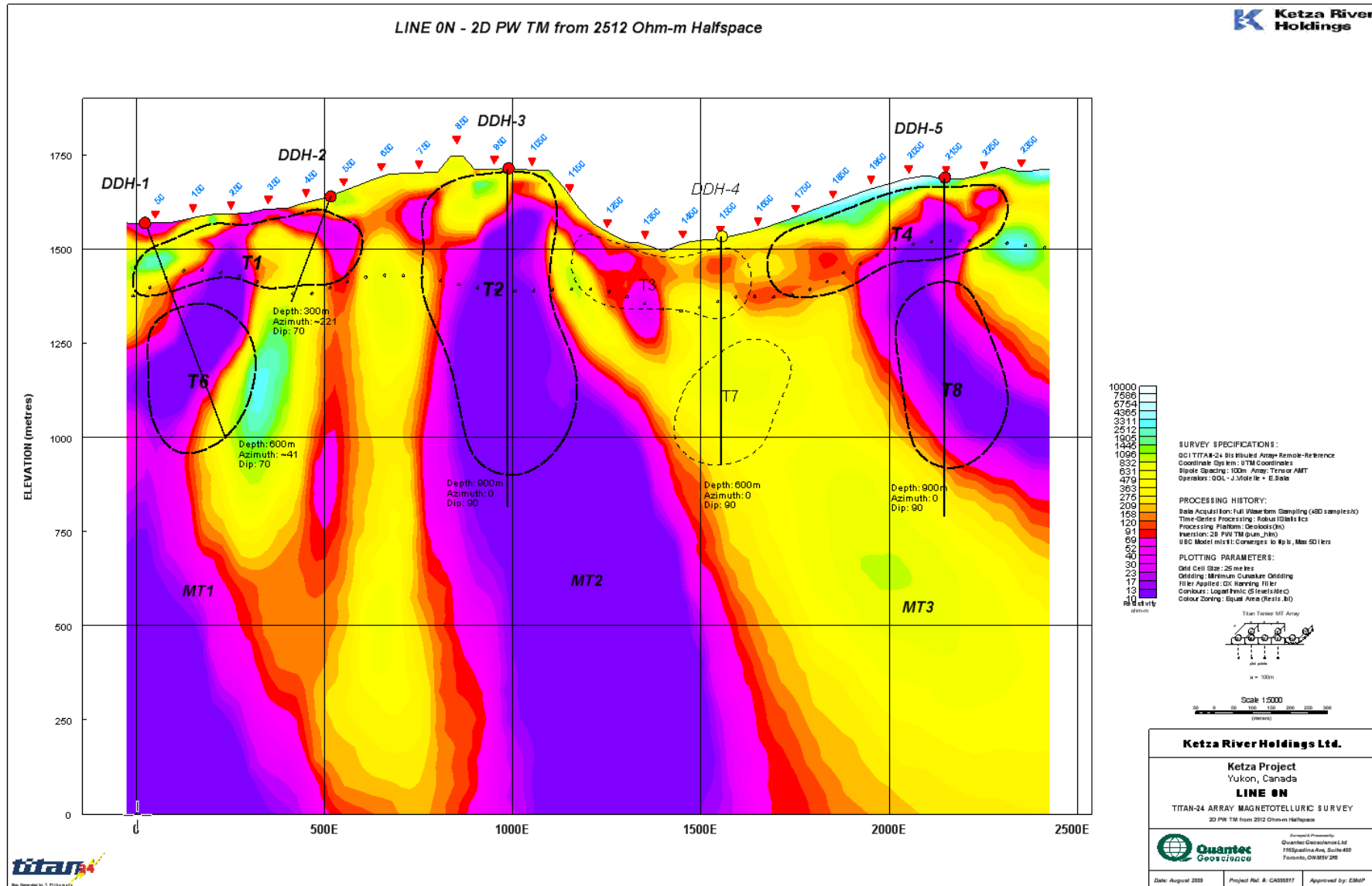


Figure IV-4: Line L0N Interpretation Section over 2D PW MT Resistivity (pum\_hm)

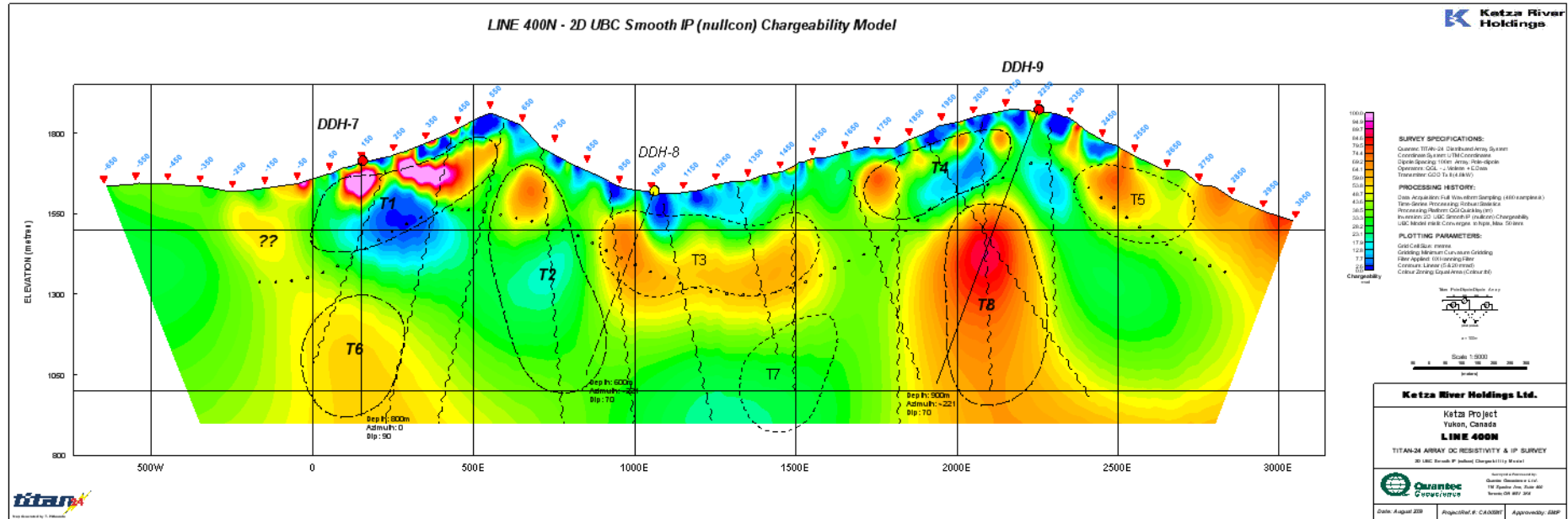


Figure IV-5: Line L400N Interpretation Section over 2D Smooth IP Nullcon Chargeability (smIP Nullcon)

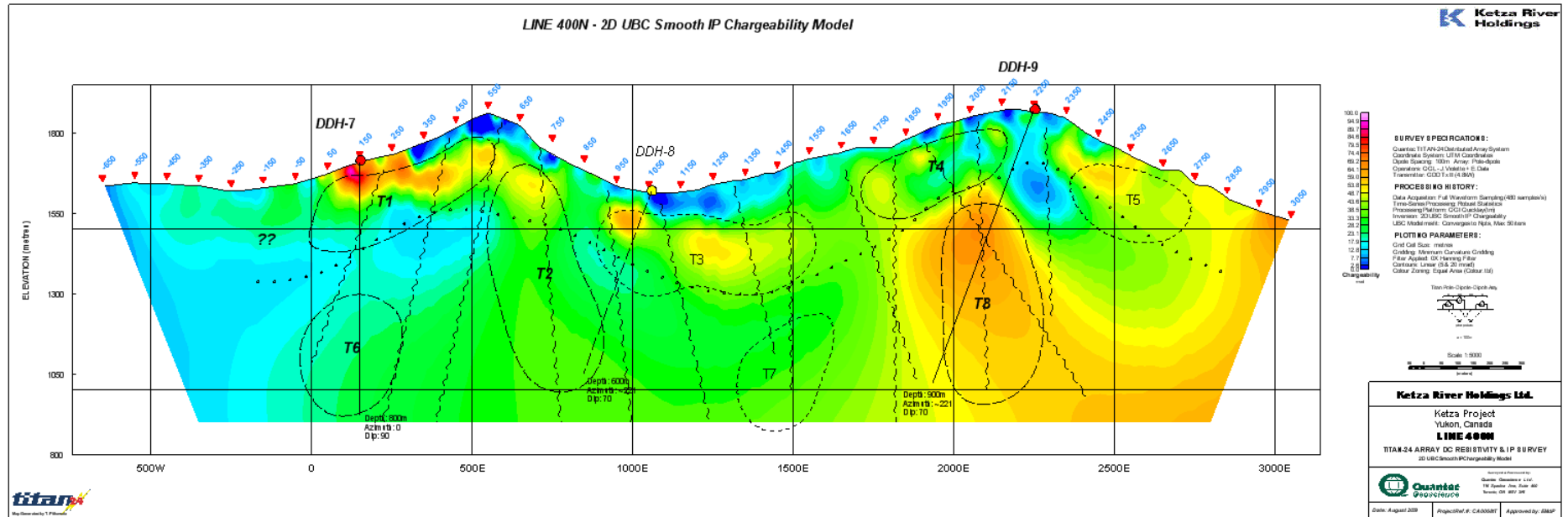


Figure IV-6: Line L400N Interpretation Section over 2D Smooth IP Chargeability

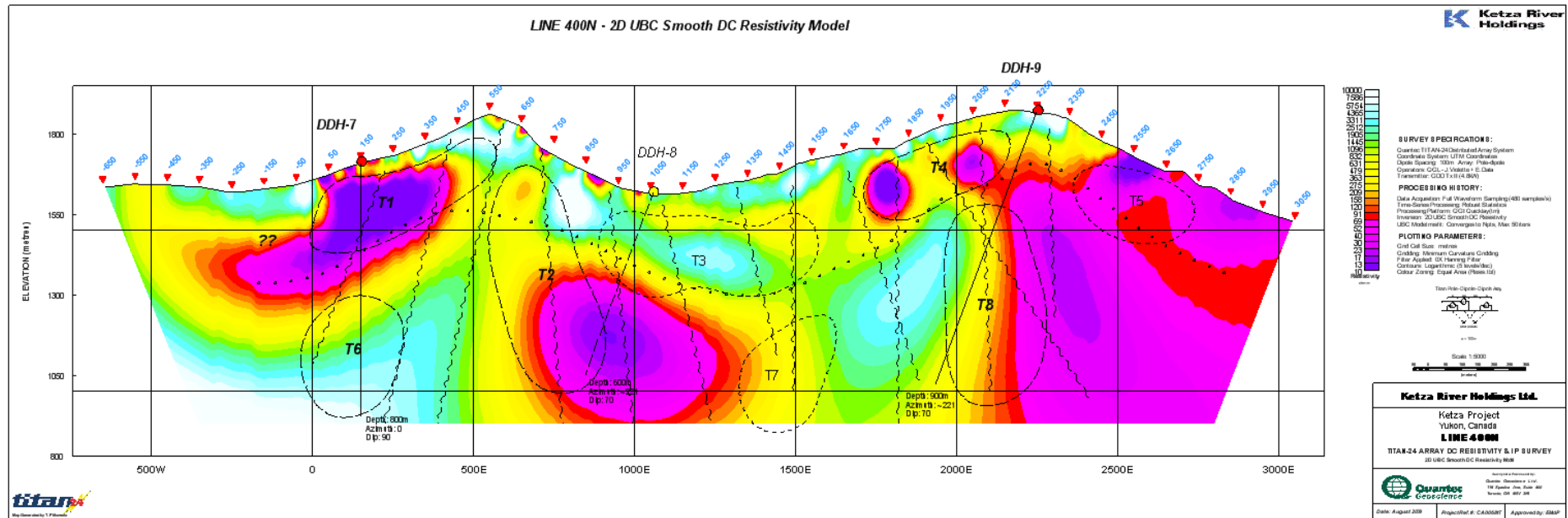


Figure IV-7: Line L400N Interpretation Section over 2D Smooth DC Resistivity (smDC)

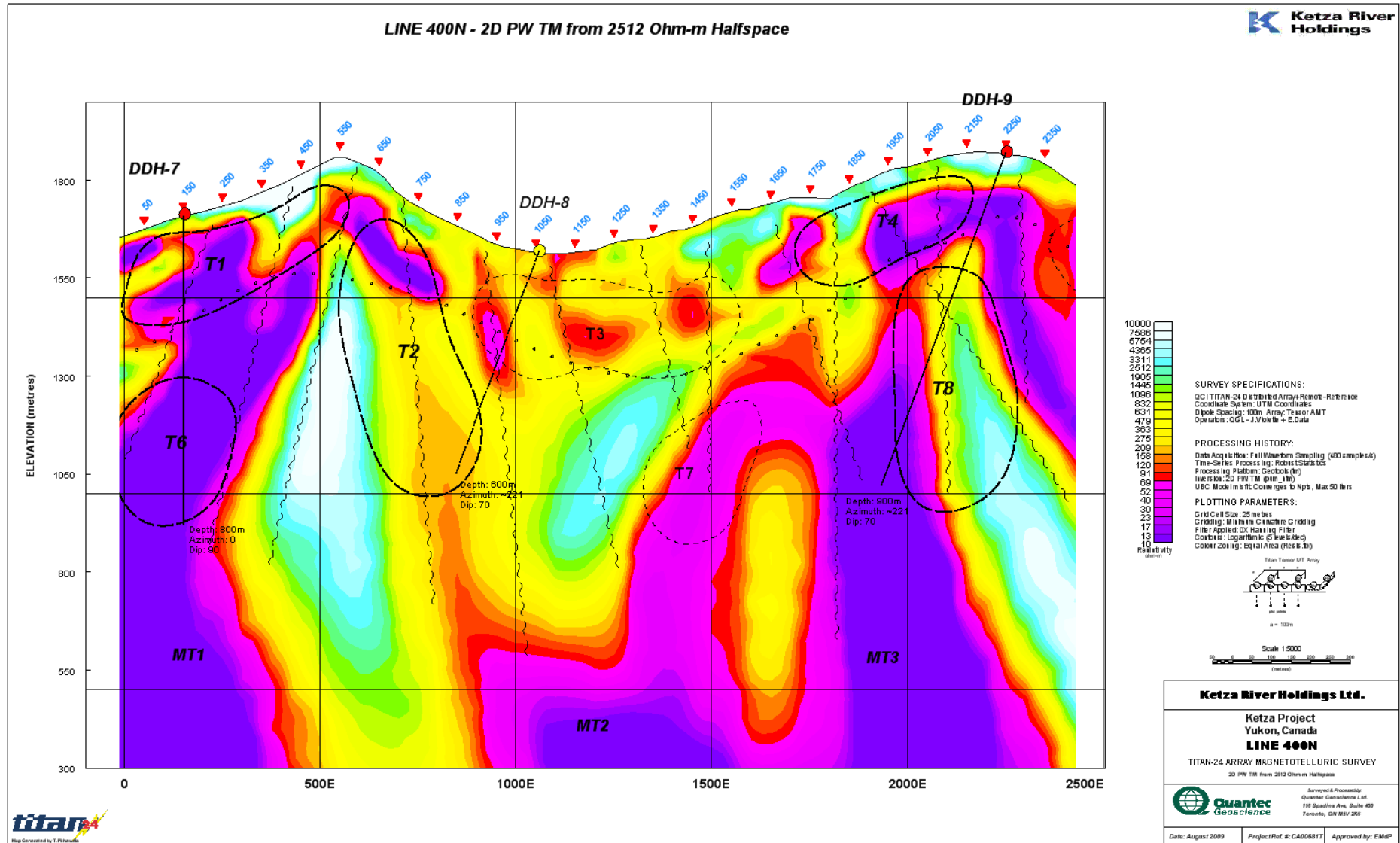
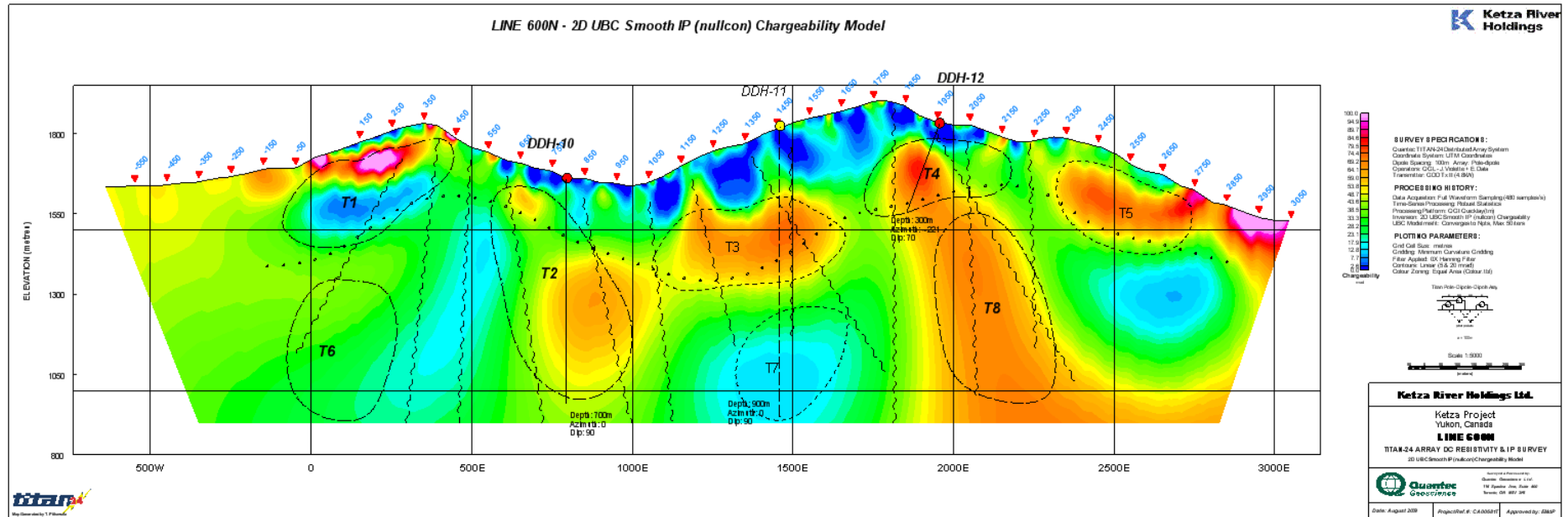


Figure IV-8: Line L400N Interpretation Section over 2D PW MT Resistivity (pum\_htm)



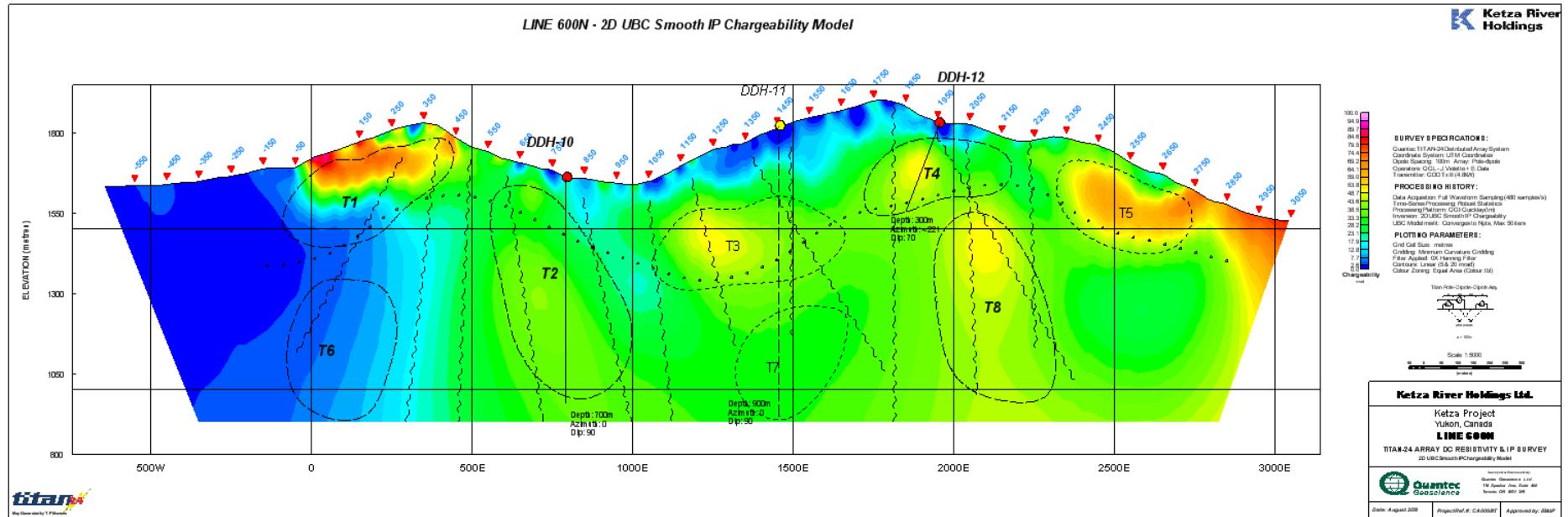


Figure IV-10: Line L600N Interpretation Section over 2D Smooth IP Chargeability

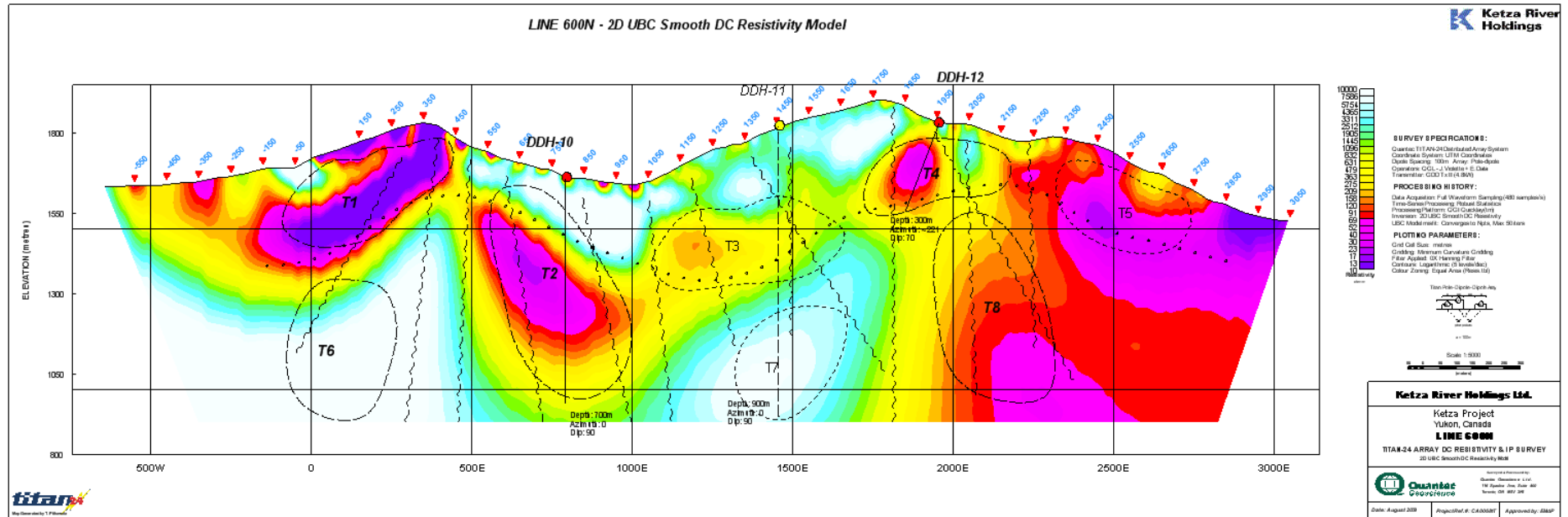


Figure IV-11: Line L600N Interpretation Section over 2D Smooth DC Resistivity (smDC)

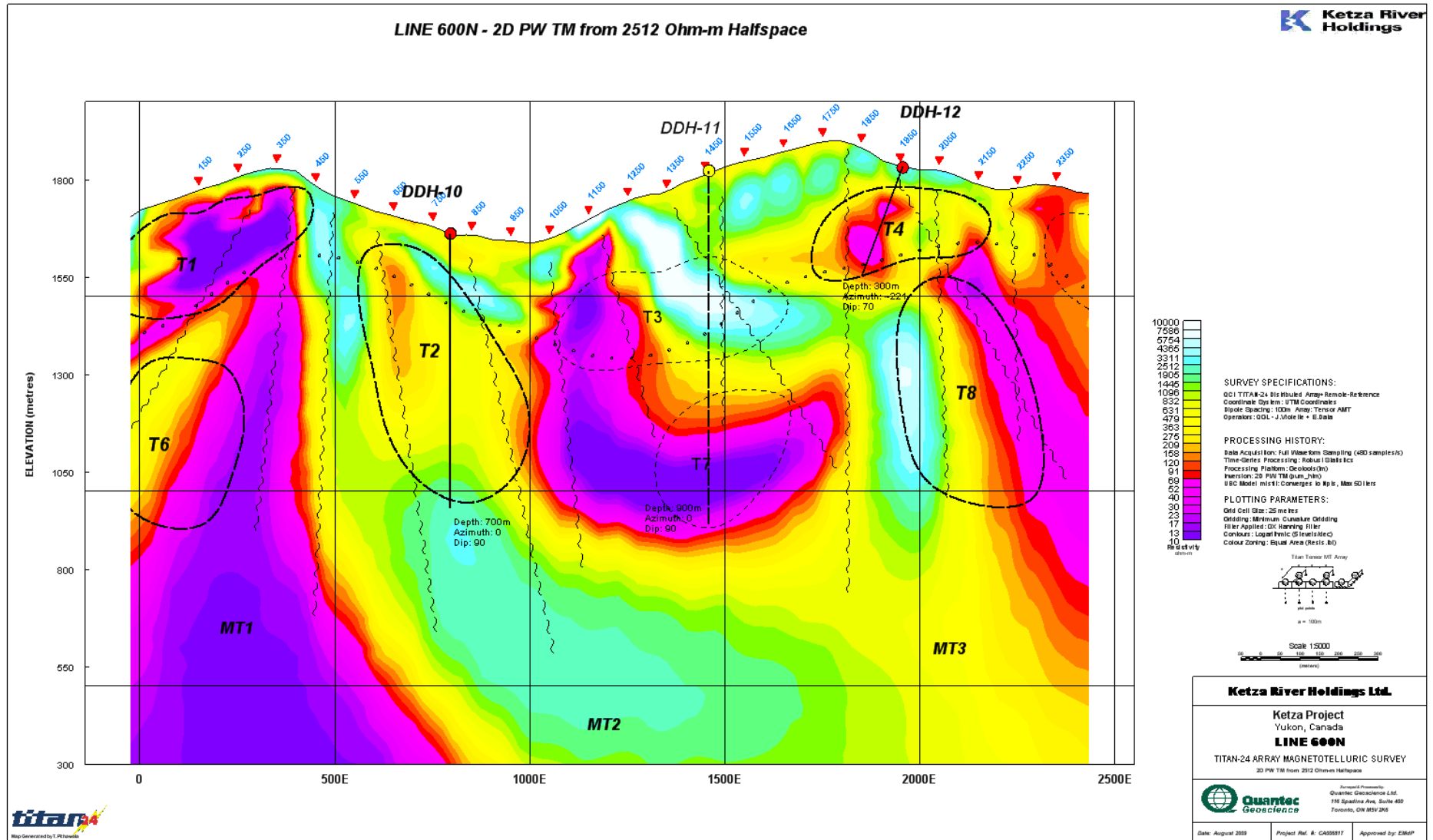


Figure IV-12: Line L600N Interpretation Section over 2D PW MT Resistivity (pum\_htm)

## V. Interpretation Plan Maps

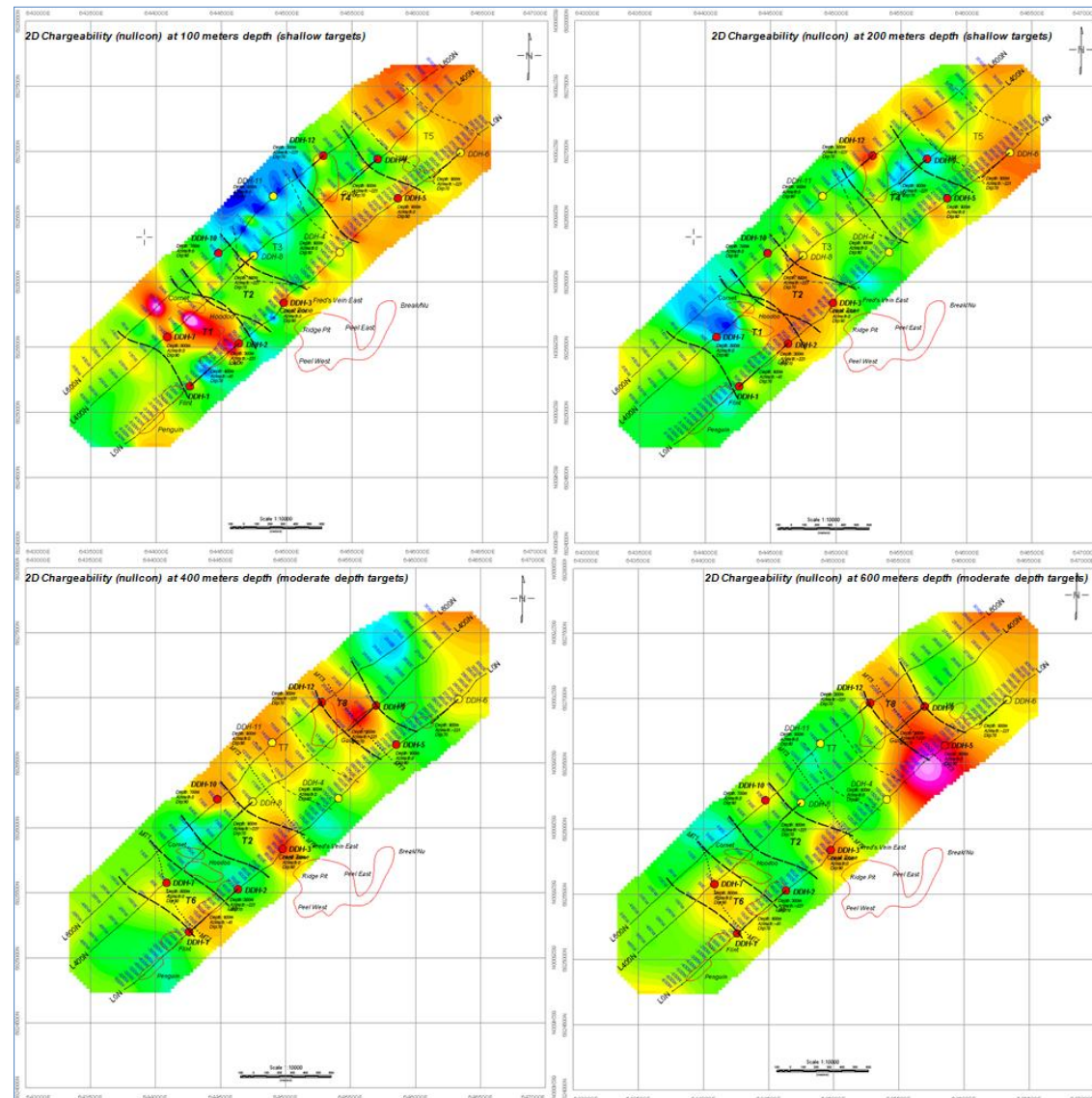


Figure V-1: Interpretation Plans over 2D Smooth IP Nullcon Chargeability (smIP Nullcon) at 100m, 200m, 400m and 600m depth

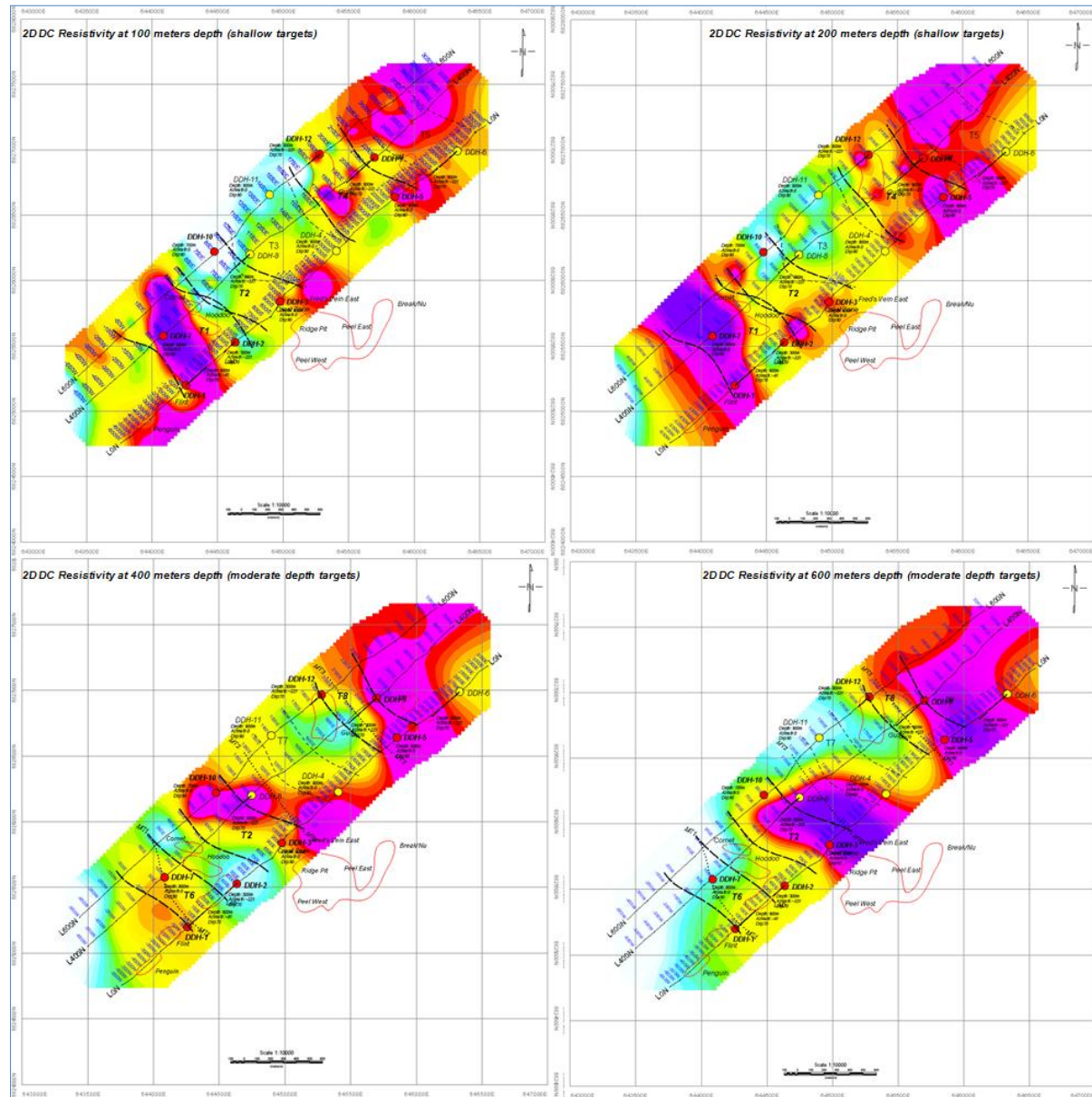


Figure V-2: Interpretation Plans over 2D DC Resistivity (smDC) at 100m, 200m, 400m and 600m depth

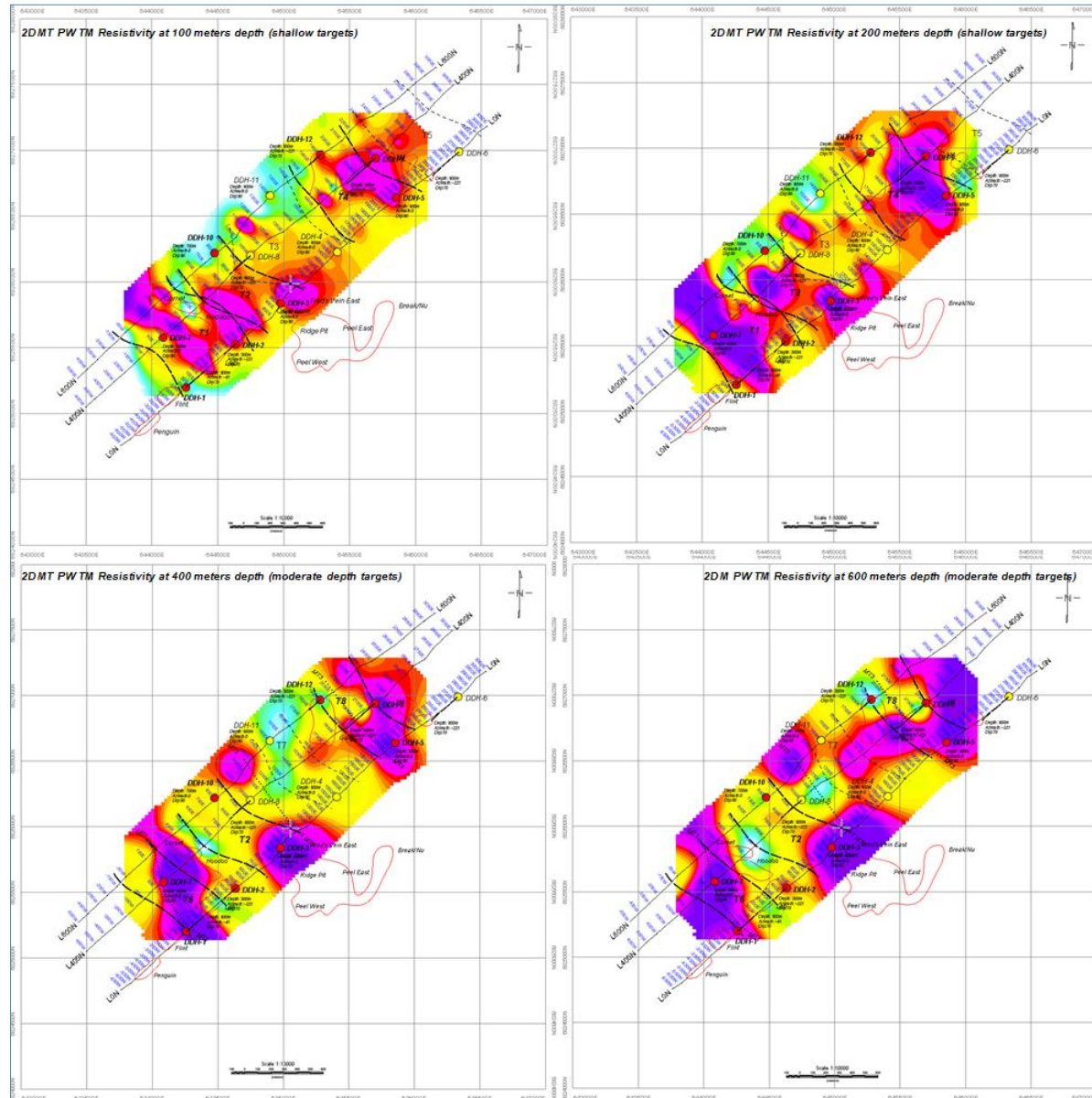


Figure V-3: Interpretation Plans over 2D PW MT Resistivity (p<sub>um</sub>\_htm) at 100m, 200m, 400m and 600m depth

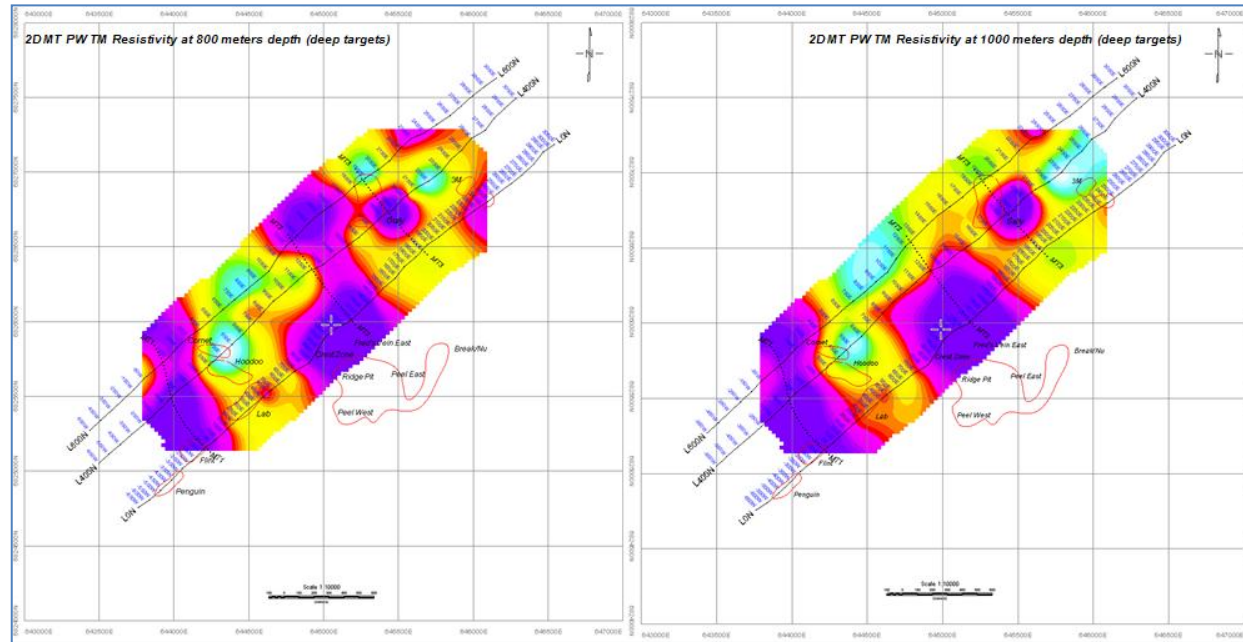


Figure V-4: Interpretation Plans over 2D PW MT Resistivity (pum\_htm) at 800m and 1000m depth

## APPENDIX G - DIGITAL ARCHIVE

### DIGITAL DVD DATA ARCHIVE ATTACHED ONTO INTERPRETATION REPORT INCLUDES:

- **DVD 1 OF 1:\CA00681T\_KETZA PROJECT\_KETZA RIVER HOLDINGS LTD\**
  - ▣ **CA00681T\_Ketza Project\_KETZA RIVER HOLDINGS LTD**
    - ▣ Contract
    - ▣ Inversions
      - ⊕ DCIP
      - ⊕ Exports
      - ⊕ MT
    - ▣ Maps and Sections
      - ▣ Base Maps
      - ▣ Geological Maps
      - ⊕ Geosoft Plans
      - ⊕ Geosoft Sections
      - ▣ Miscellaneous
      - ▣ Programs
    - ▣ Reports
      - ▣ Interpretation Report
      - ▣ Logistics Report
      - ▣ Operator Logs
      - ▣ Parallel Sensor Test Report
      - ▣ Pictures & Figures
      - ▣ Presentations
      - ▣ Processor Reports
      - ▣ Production Summary
    - ▣ Results
      - ▣ CSV and Response Files- IP
      - ▣ EDI Files- MT
      - ▣ GPS and Survey Files
      - ▣ Parallel Sensor Test
      - ▣ SDM Files-MT
      - ⊕ TS Files
      - ⊕ XYZ Files
    - ⊕ TITAN 24 Field Data and Reports

## INNOVATIVE EXPLORATION SOLUTIONS

### GEOPHYSICAL EXPERTISE:

Geophysical consulting services, data acquisition and interpretation, geophysical inversion modeling and geologically constrained inversion.

### ELECTROMAGNETIC:

3D surface TEM profiling, 3D Borehole TEM profiling to 2300m, TEM Centre-loop resistivity soundings for lithologic mapping, geothermal and groundwater exploration.

### INDUCED POLARIZATION:

Real Section IP, Harmonic Spectral IP / Resistivity (Phase IP) with proprietary techniques for telluric cancellation.

### ELECTRICAL:

Controlled Source Audio-frequency Magnetotelluric, Multi-vector Magnetotelluric, Scalar Audio-frequency Magnetotelluric, Audio-frequency Magnetotelluric.

### POTENTIAL FIELD:

Gravity, magnetics modeling and inversion.

### MINE SITE EXPLORATION:

Specialists in mine site exploration, offering a robust program of deep imaging in and around mine sites. Combining 3D earth modeling with data collection in the most extreme environments affords working mines a new way to explore in the shadow of head frames.

## Global Geophysical Solutions

Quantec Geoscience provides geophysical services to the mining industry with a focus on data acquisition, interpretation and survey execution.

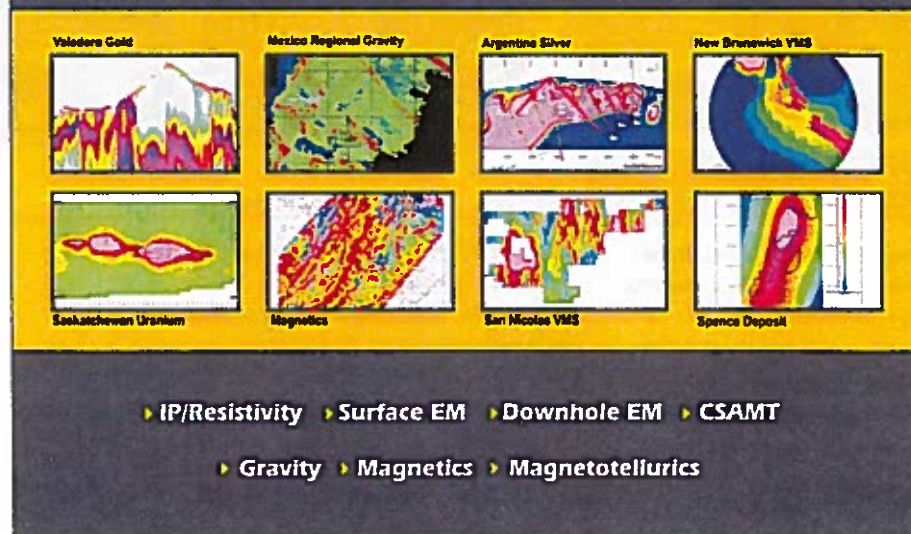
With over twenty years of operations, Quantec is an established leader in providing exploration solutions. Committed to employing innovative processes and advanced technology, Quantec continues to build its reputation of being a pioneer in the geophysics industry.

- Global Operations since 1986
- Offices in Eight Countries: Canada, U.S.A, Chile, Argentina, Peru, Mexico, Australia and Botswana
- 2000 projects completed in over 30 countries
- Team of over 100 geophysicists, geophysical technologists and project-based field assistants

### Our Mission:

- To provide the greatest opportunity of success for our clients through innovative quality applications of technology
- To technically differentiate both our company and our clients in order to maintain a competitive market advantage
- To act with integrity and operate professionally, ethically, and with the highest regard for quality of services, products and the environment

## Helping With Discovery for Over 20 Years





## EXPLORATION ENVIRONMENTS:

- Grass Roots exploration
- Advanced deposit delineation and evaluation
- Predevelopment mill site
- Brownfield mine site surveys

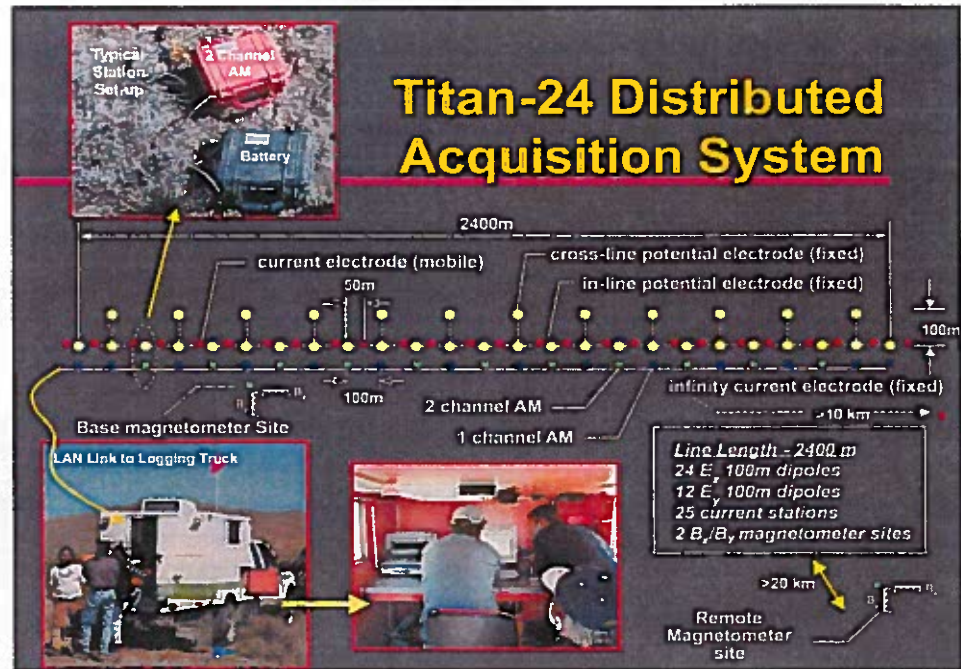


## Leading Through Technological Innovation

Quantec's proprietary *Titan 24 Deep Earth Imaging System* is the most advanced electrical earth imaging technology to date. This distributed acquisition method combines two surveys in a 24 hour period measuring to depths of 750 metres with IP/Resistivity, and exploring beyond 1500 metres with MT-resistivity data.

## EXPLORATION TARGETS:

- VMS Copper Zinc
- Porphyry Copper
- Unconformity Uranium
- Nickel Sulfide
- Epithermal Gold
- Diamonds



## About Quantec

Quantec Geoscience Ltd. has been helping with discovery for over 20 years.

Our offices throughout the world allow access to a collective knowledge database of thousands of projects with practically all possible geophysical surveys.

## Global Office Locations

**Head Office: Toronto, Canada**  
416 306 1941

ARGENTINA - Mendoza: 54 261 4961414

AUSTRALIA - Brisbane: 07 3359 0444

BOTSWANA - Lobatse: 267 533 0954

BRAZIL - Goiânia (Terracorp): 55 62 3541-3747

CHILE - Santiago: 56 55 2511428

INDIA - Mumbai: 91-22-27820978

MEXICO - Hermosilla: 775 530 6948

PERU - Arequipa: 51 54 288686

USA - Reno: 775 827 2611



**Quantec**  
Geoscience

## Titan 24 DCIP & MT Distributed Surveys

### DISTRIBUTED MT/IP ARRAY TECHNOLOGY:

This system is the result of a 4-year effort to develop advanced tools for precise and deep subsurface information. Designed to collect highly accurate full wave form information through distributed 24-bit receivers, Titan 24 is proven technology that has been applied in over 100 surveys, and has imaged several impressive ore bodies found at depths greater than 500 metres.

The crews are experienced, the system is robust and can be executed just about anywhere. Surveys have been carried out in a variety of geological settings and geographic conditions and climates.

### IP:

Deep chargeability data collected with  $n=1-24$  and greater, an "a" spacing of 50, 100, 150 or 200 metres provides greater data density and deeper penetration for accurate IP chargeability and DC resistivity inversions to depths of 750 metres.

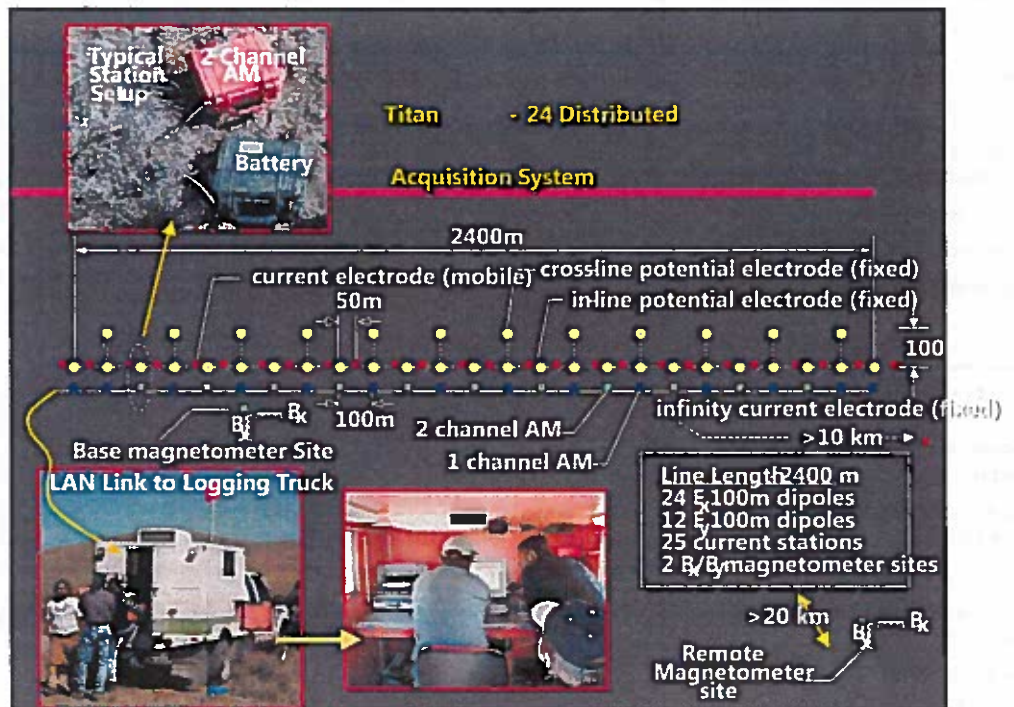
### MT:

Magnetotelluric resistivity data collected over a long recording period and large frequency range at 24 stations simultaneously with 100 metre station separation provides greater lateral resolution and accurate imaging of resistivity to depths of 1 to 2 kilometres, and greater. Proprietary inversion software, developed by Phil Wannamaker, yields more accurate resistivity imaging capabilities.

### TITAN 24 - Deep Electrical Earth Imaging

The array based Titan 24 Deep Earth Imaging system is the most advanced electrical earth imaging technology to date. Measuring the parameters of DC (resistivity), IP (chargeability) and MT (magnetotelluric resistivity), Titan 24 measures to depths of 750 metres with IP, and can explore beyond 1.5 kilometres with MT data. These depths and multi-parameter data make the system the best option available for obtaining subsurface pre-drilling information related to geologic structure,

and for the detection of mineral deposits anywhere in the world. Titan 24 can highlight subtle features through thick cultural overburden, making it an important investigation tool where the effectiveness of traditional methods has been limited. The system provides a strategic advantage at grass roots stages, and allows for the reassessment of areas covered previously by less sophisticated exploration methods in and around established mining grounds.



### Features:

- Improved accuracy of MT data due to high resolution signal processing and simultaneous field measurements, continuous profiling and a broad band AMT/MT, frequency range of 10kHz to 0.001Hz
- Sophisticated digital signal processing
- High volume full waveform data sets (multi-fold) drives accuracy into the inversion process providing high resolution and improved interpretability
- Deep DC/IP information from multi technique, multi current injection,  $N > 20$
- Rapid Data Collection
- Fast Interpretation

# Titan 24 DCIP & MT Distributed Surveys

## Deeper Exploration

### EXPLORATION

#### TARGETS:

- Gold
- VMS Copper Zinc
- Nickel Sulfide
- Porphyry Copper
- Unconformity Uranium
- Diamonds

#### APPLICATIONS:

- Penetrate thick overburden
- Focus deep drilling
- Delineate and evaluate deposits
- Deep regional earth studies
- Grassroots exploration
- Brownfield mine site surveys

#### BENEFITS:

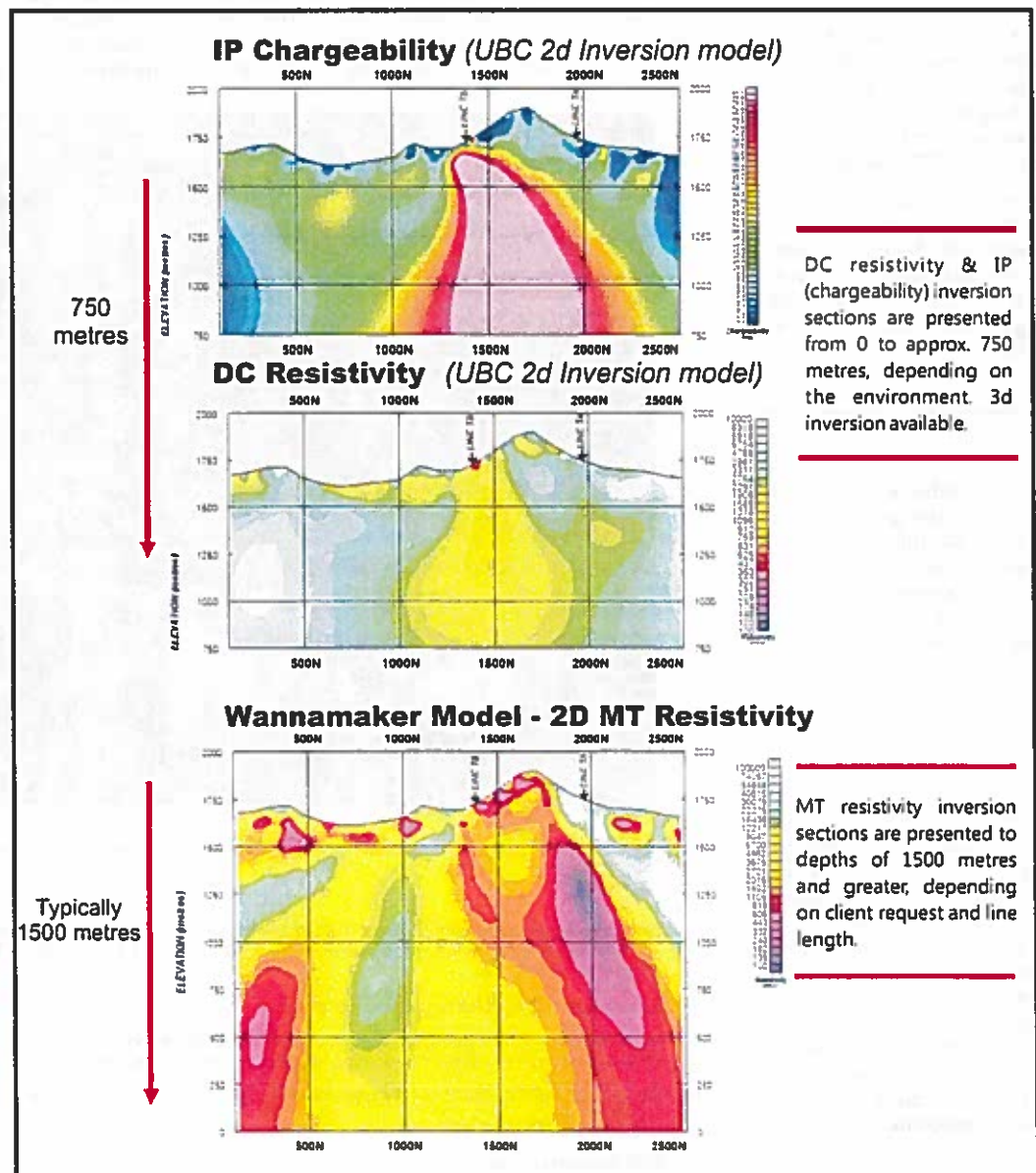
- Rapid and thorough exploration
- Characterization of principal ore bodies
- Discovery of new targets
- Focused drilling and effective drill budgeting
- Reduced risk
- Build investor confidence and attract financing

**Titan 24 is the most sophisticated technology in the world for collecting deep subsurface information down to 1.5 kilometres.**

As large ore bodies become increasingly difficult to find, deeper exploration is becoming increasingly relevant in today's mining environment. By looking deeper into a property, its true value can be assessed up front, resulting in greater foresight into a project's long term potential.

While deep drilling can be expensive, Titan 24 focuses drilling and achieves success by clearly prioritizing targets. With the depth achieved, Titan 24 is a highly cost effective means to not only unlocking, but realizing a properties full value.

### Typical Data Products from a Titan 24 line



DC resistivity & IP (chargeability) inversion sections are presented from 0 to approx. 750 metres, depending on the environment. 3d inversion available.

MT resistivity inversion sections are presented to depths of 1500 metres and greater, depending on client request and line length.

## Titan 24 DCIP & MT Distributed Surveys

**Anywhere, Any Weather!**

### MINESITE EXPLORATION:

Titan is capable of working in highly cultured areas where traditional geophysics are limited, presenting a new way to target drilling in and around minesites. Distributed technology, digital signal processing and data over sampling are some of the features of Titan 24 technology that allow the acquisition of information in culturally harsh environments.

### TITAN HAS DETECTED...

#### Ni Sulfide:

Raglan 8H - 600 m  
Voisey's Bay - 600 m  
Nickel Rim South - 1000 m

#### VMS:

San Nicholas - 300 m  
Half Mile Lake - 600 m

#### Copper Porphyry:

Kemess North - 500 m  
Resolution - 1400 m

#### Unconformity Uranium:

Shea Creek - 700 m



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CHILE - Santiago: 56 55 2511428

INDIA - Mumbai: 91-22-27820978

MEXICO - Hermosillo: 775 530 6948

PERU - Arequipa: 51 54 288686

USA - Reno: 775 827 2611



**Quantec**  
Geoscience



## Titan 24 DCIP & MT Distributed Surveys

### Our Clients Make Discoveries & Effective Drilling Decisions

#### Northgate Minerals Corporation – Porphyry Copper

"The discovery of another large mineralized system in the Kemess camp is very exciting. Equally important is the success of the Titan 24 deep penetrating IP survey technique, which has proven itself to be an excellent predictive tool for spotting drill holes on the Kemess property in areas where there is no surface expression of mineralization."

President and CEO, Ken Stowe

#### African Copper Plc – Copper

"Drilling of Titan 24 geophysical anomalies led to an extension of known mineralization for 350 metres to the south. The discovery of previously unknown mineralization within the deformation zone at Dukwe was a direct result of using the Titan 24 geophysical system. This cutting-edge technology has allowed us to extend mineralization within sight of our processing facility. We are excited by the success that has been achieved in the drill testing of the first Titan 24 generated target."

CEO, Joseph Hamilton

#### Lonmin Plc – PGM, Gold

"Lonmin is pleased to announce the discovery of a new zone of significant low sulphide high PGM mineralisation on the Capre property, see Figure 1, one of six properties which comprise the previously announced PGM joint venture with CVRD Inco Limited in Canada's Sudbury Basin. The mineralisation has been intersected in 10 holes drilled on a south plunging weak Titan IP anomaly generated by a surface geophysical survey."

Vice President, Investor Relations and Communications, Alex Shorland-Ball

#### Tribute Minerals – Copper, Zinc

"Tribute Minerals is pleased to report on the results of the fourth hole (GL-2004-04) from its four hole -2,280 metre Phase 1 diamond drilling program on the Arrow zone of the Garnet Lake Property in the Confederation Lake area, Red Lake Mining Division, northern Ontario. The hole intersected high grade zinc and copper mineralization with 4.25 metres of 17.41% Zn and 0.68% Cu. The drill program was designed to test targets identified by the Quantec Geoscience Inc. Titan 24 IP/MT geophysical survey."

President and CEO, Ian Brodie-Brown

#### Escape Group – Gold

"The Escape Group recently surveyed the Red Rock gold property in Nevada using the Titan 24 DCIP and MT geophysical technology. This modern and highly advanced system was used to enhance the exploration model prior to initiation of a diamond drill program. Chris Pratt, V.P. Exploration expanded the original Titan survey once the preliminary data was received as the geophysical signature extended the known targets outside the Discovery Zone to the north towards the Red Rock thrust and east towards the proximal rhyolite dome."

President and CEO, T. John Magee

#### Blue Note Mining Inc. – Base Metals

"A large-scale geophysical program is planned over the Caribou and Armstrong properties for fall 2007 and winter 2008. The 210 line-kilometre ground geophysical survey has been contracted to Quantec Geoscience and will be conducted using the Titan 24 DCIP and MT system. The planned geophysical survey will allow the company to develop quality exploration targets by outlining anomalies in under explored areas along strike and down dip of the mineralized stratigraphies hosting the Caribou and the Armstrong deposits. Contingent on the geophysical survey results, an extensive drilling program is planned to follow-up the exploration targets."

Vice President, Investor Relations, Lorne Woods

#### El Nino Ventures Inc. – Base Metals

"A partially completed MT/IP Titan 24 survey conducted over the 'Brunswick Horizon', between Brunswick No.12 and Brunswick No. 6 (past producer) indicated several interesting geophysical signatures that will require follow-up work and diamond drilling. Titan 24 can measure down to depths of 750 meters (2,460 feet) with IP, and can explore beyond 1.5 kilometers (down to about one mile) with MT data. These depths and multi-parameter data make the Titan 24 one of the best options available for obtaining pre-drilling information related to geological features at depth."

Vice President, Investor Relations, Lorne Woods

#### Franconia Minerals Corporation – Porphyry Copper

"Franconia announces the results of a Titan 24 multi-channel geophysical survey conducted on the 8,000 acre Red Knoll property in Graham County, Arizona. The survey indicates that potential host rocks for a porphyry copper system are present beneath volcanic cover in an area between Phelps Dodge's Morenci mine, the largest copper producer in the US, and the Safford porphyry copper district. Franconia is targeting concealed porphyry-style copper mineralization in Laramide-age volcanic rocks buried beneath post-mineral volcanic cover."

President, Bruce Gavin

#### Cypress Development Corp. – Gold

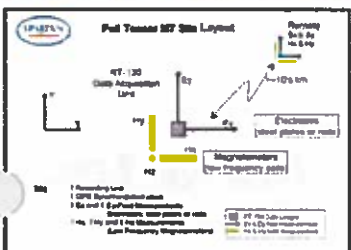
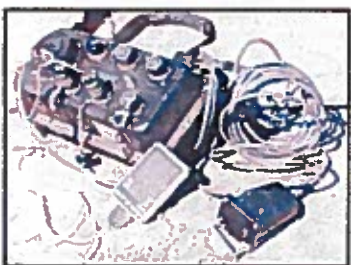
"A 'Titan 24' electrical survey was completed on the Gunman property. The Titan 24 survey results indicate a series of strong, discrete conductors apparent along Titan line 300E. Detailed geologic control from surface mapping indicates that these three conductors occur within north to south striking RH Zone stratigraphy, and represent a very prospective series of anomalies."

Vice President of Explorations, David J. Busch

# Spartan MT Deep Resistivity Sounding

## GEOPHYSICAL EXPERTISE:

The magnetotelluric method is used to map the spatial variation of the earth's resistivity by measuring naturally occurring electric and magnetic fields at the earth's surface. These natural EM fields are generated in the atmosphere mainly by solar wind and distant lightning strokes.

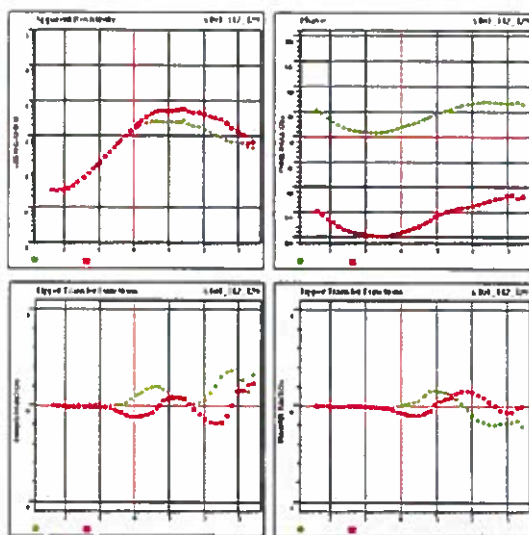


The full tensor Spartan MT system provides a unique way to obtain deep resistivity over a variety of terrains. The system is typically deployed to collect deep resistivity in semi regional to regional applications, from 300 metre to 2000 metre site separation. With high portability and flexibility of distribution,

Spartan MT is environmentally friendly and unobtrusive, with depth of investigation from 400 metres to 10,000 metres, and more.

Spartan MT can also be used to help target Titan 24 distributed surveys to collect more precise and deep subsurface information.

## MT SOUNDING CURVES



Sample MT curves from the 2007 Isa-Georgetown-Charters Towers Research Project, a collaborative project undertaken by Geoscience Australia and the Geological Survey of Queensland (Department of Mines & Energy) and using the services of Terrex Seismic and Quantec Geoscience.

Data shows three days acquisition to obtain 1000 sec MT data and obtaining deep information on the lower crust (+20-30kms).

Data shown courtesy of



## REGIONAL TRANSECT



240 kilometre traverse in northwest Nevada, a basin and range geologic setting. Data inverse modeled to 25 kilometres depth, showing top of conductive structure at 9 kilometres.

## FEATURES:

- Improved accuracy of MT data due to high resolution signal processing, simultaneous field measurements, continuous profiling, and a broad band MT at a frequency range of 400 Hz to 0.001Hz
- Sophisticated digital signal processing
- High volume full, multi-fold wave-form data sets drive accuracy into the inversion process improving resolution and interpretability



# Spartan MT Deep Resistivity Sounding

## Structural Mapping

### APPLICATIONS:

- Deep terrain-scale structural mapping
- Large area target potential evaluation
- Environmentally sensitive and remote terrain
- Extremely rugged terrain
- Shallow crustal-scale hydrocarbon exploration
- Deep crustal studies
- Geothermal exploration

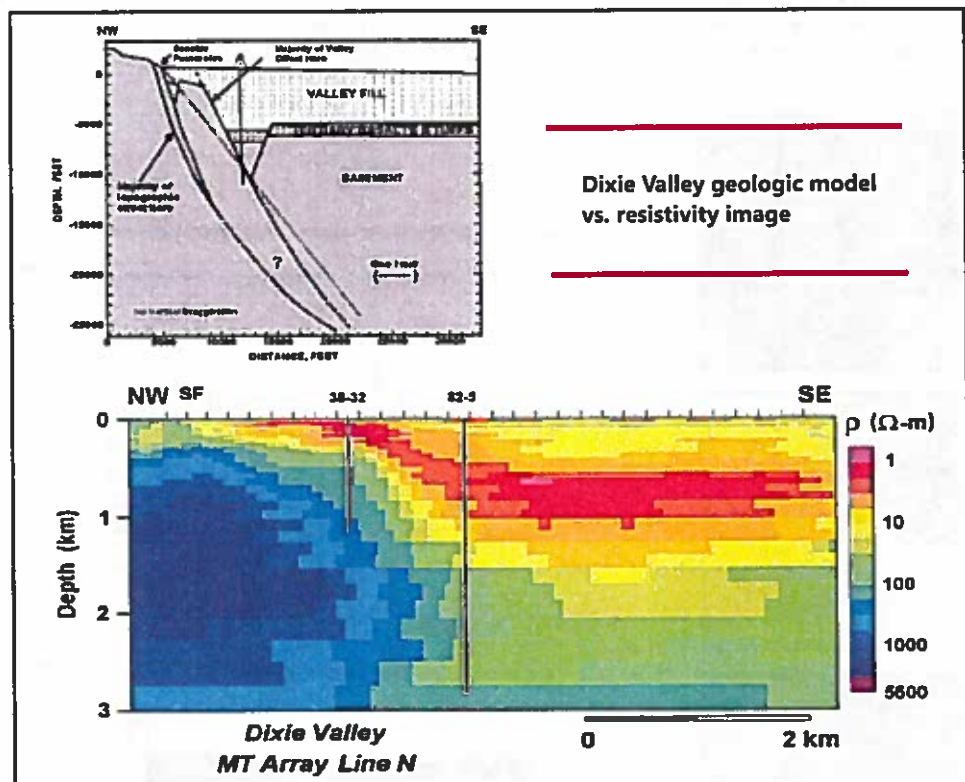
Electrical resistivity can be strongly affected by geothermal processes. Historically, subsurface resistivity images are lacking in resolution due to limited data type, poor data sampling and inadequate inversion approaches. MT signals are small in amplitude and require careful processing to achieve accurate response functions. The Spartan MT system uses proprietary

inversion software developed by Phil Wannamaker, providing better tools, methods and data.

Below, initial results of a Spartan MT survey at the Dixie Valley geothermal field in NW Nevada, within the fields of late Cenozoic volcanism. MT resistivity image corresponds well with geologic model.

### OIL & GAS APPLICATIONS:

Traditionally, MT technology has been used to provide a means of determining the thickness of overlying volcanic or crystalline rock, which hinders the ability of seismic to map the subsurface. Deep resistivity can provide a means of discriminating between various seismic traps, for example water filled versus gas filled, since the water represents a much greater conductivity. This discrimination provides cost savings for deep drilling programs.



Dixie Valley geologic model vs. resistivity image

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# Phoenix Zone - Wheeler River

## RESULTS:

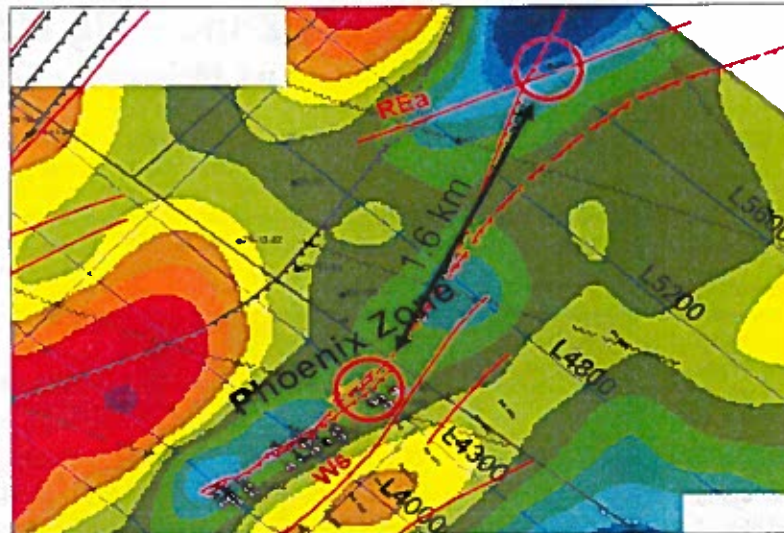
The unconformity uranium mineralization was initially intersected in drill holes targeted at resistivity lows detected by the Titan DC Resistivity survey. The overall results confirm, and significantly exceed, previously reported grade equivalent results from the Wheeler River property.

Uranium mineralization has subsequently been intersected along a 1.5 kilometre trend of the basement conductor. The mineralization has contained up to 55% U3O8 over 6 metres.

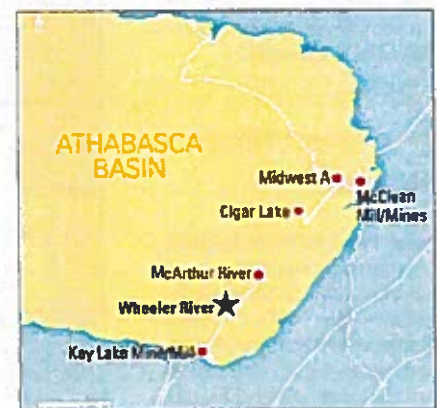
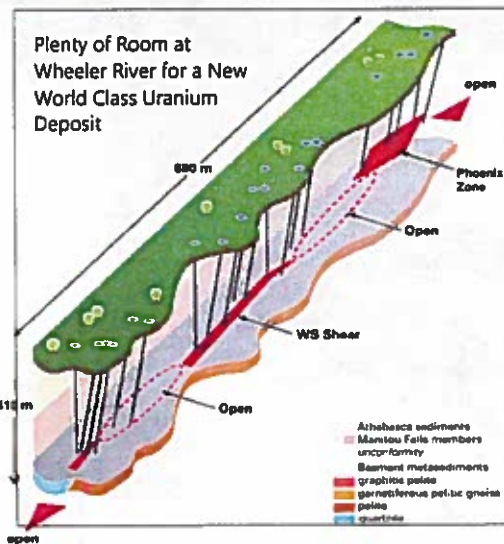
**Phoenix West:** Minor mineralization was detected upon drilling hole WR-270. The western portion remains open along the unconformity and supplementary drilling is planned for 2010 to further evaluate the high-grade mineralization and intense alteration zone encountered to date.

**Phoenix East:** High-grade uranium mineralization was intersected at a depth of approximately 400 metres, extending the zone 150 metres further to the northeast to a strike length of over 250 metres. For the first time, severe alteration of this type has been encountered in the basement rocks along the Phoenix mineralized trend.

The remainder of the program will focus on extending the eastern portion along strike, in preparation for a major resource delineation program.



Titan DC Resistivity depth slice shows the continuity of the conductive zone



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# Quantec Geoscience

Leaders in Deep Exploration

## CHALLENGES:

Porphyry targets, although typically large, can be found at a variety of depths, often in areas of extreme topography and talus. The standard approach to exploring for porphyries has included geochemistry, drilling and traditional depth-limited geophysics.

## SURVEY:

A geological model was developed with several zones of potential mineralization to test Titan's DC IP sensitivity to mineralization at depths ranging from 300 to 600 metres. Plans were made to utilize helicopter support for crew and equipment placement along a 5 kilometre line.

## FORWARD MODEL STUDY RESULTS:

The chargeability forward model and resulting inversion indicated that potential zones would be well resolved to depths below 400 metres, and that a survey would be beneficial. A cross line was then planned assuming the results from the longitudinal line were favourable.

## Titan 24 RESULTS:

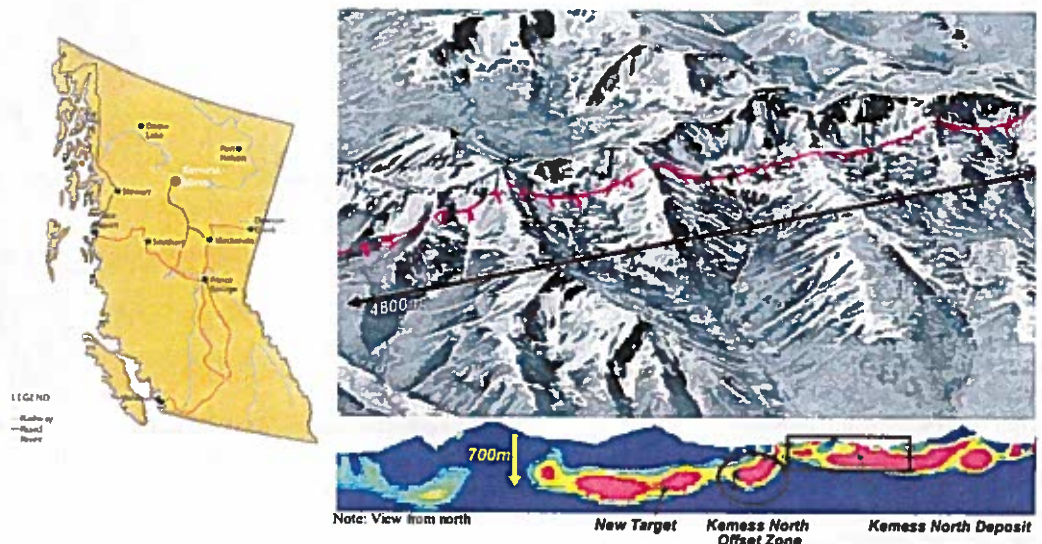
The survey outlined several previously unknown exploration targets. Titan data worked extremely well in mapping the sulfide rich cap zones to depth.

The proposed mineralized geologic model was corroborated and drilling could then be focused into specific target regions for further exploration. Barren zones may be considered significantly explored.

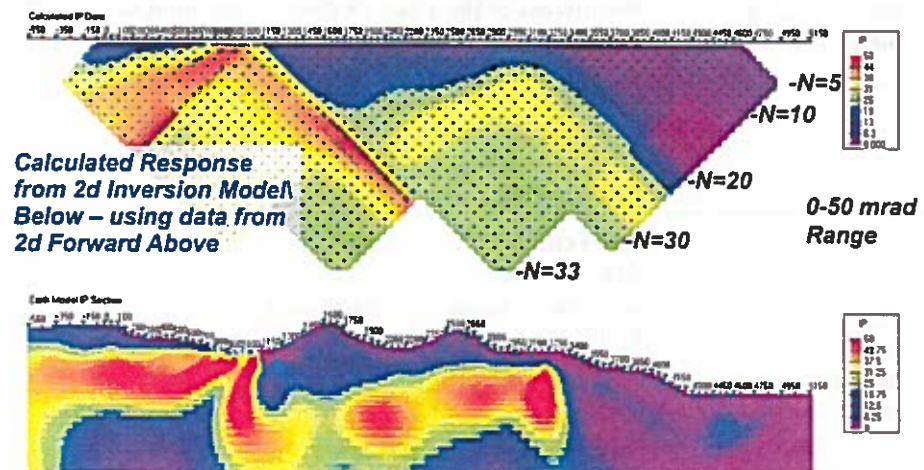
## Deep Search Technology Leads to New Porphyry Discovery

The Kemess mine in Northern B.C. consists of an open pit copper-gold mine, and several undeveloped deposits. The topography is varied, including regions of gentle slopes and rugged mountain terrain. Previous drill testing had returned encouraging results, but was unsuccessful in outlining the prospective mineralization.

To assist exploration, a Titan 24 survey was designed and tested prior to the actual survey. Titan 24 has been proven to detect copper porphyry ore bodies at depths of 1400 metres by Rio Tinto at the Resolution discovery, and can differentiate large high tonnage potential deposits from small mineralized bodies providing effective drill targeting.



**Kemess East Proposed Porphyry Model Synthetic Titan Data (view from south)**



Chargeability Inversion (2d Smooth model)

Titan 24 is a distributed array system, measuring IP chargeability and resistivity to depths of 750 metres, and Magnetotelluric resistivity to depths of 1.5 kilometres.



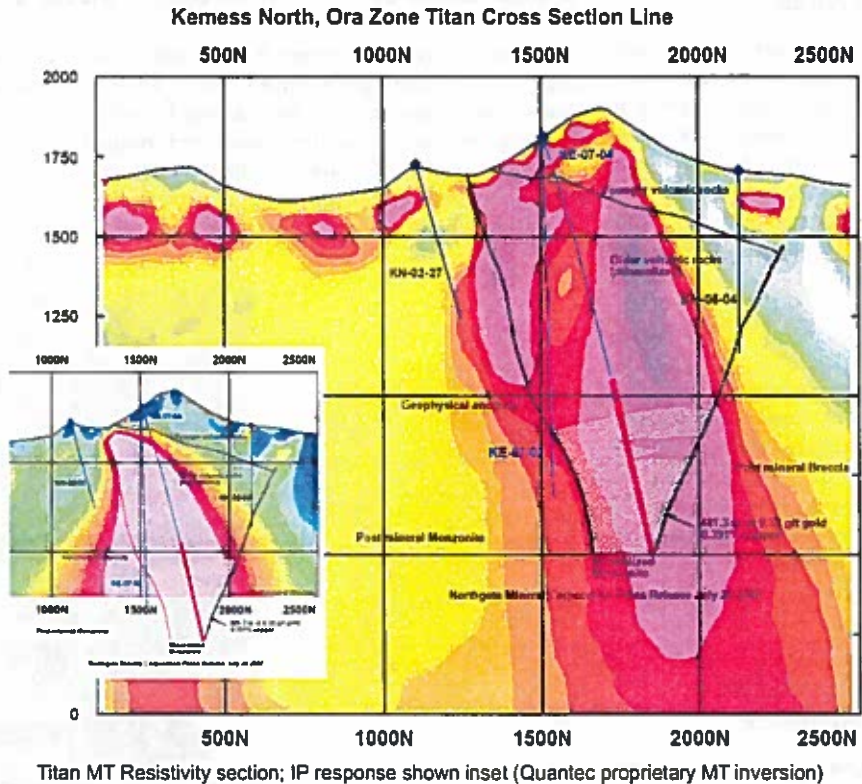
## Copper Porphyry Exploration- Kemess Mine

### FOLLOW-UP DRILL RESULTS:

The Ora Zone discovery was made from a drill program designed to test the deep Titan 24 charge-ability anomaly that was defined in 2006. Hole KH-07-04 intersected the longest mineralized interval ever drilled on the Kemess property with 441.3 metres of 0.38 g/t gold and 0.391% copper.

This hole also represents the deepest mineralization (850 metres deep) so far discovered in the Kemess camp, and due to its grade and thick-ness it represents a very exciting discovery.

The MT mapped the Ora zone where copper mineralization was found at a depth of 700 metres. While the relationship between this mineralization and the Kemess North deposit is unknown, the Titan 24 results and this new discovery suggest that the Kemess North mineralizing system is far more extensive than previously understood.



**“A third large gold-copper porphyry system discovered at Kemess.... The discovery of another large mineralized system in the Kemess camp is very exciting. Equally important is the success of the Titan 24 deep penetrating survey, which has proven to be an excellent predictive tool for spotting drill holes...”**

Ken Stowe, President and CEO

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### Saving Time & Money Exploring Near Mines

**CHALLENGES:**

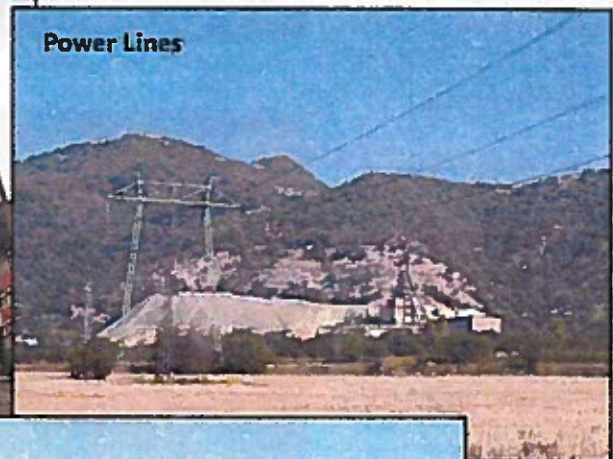
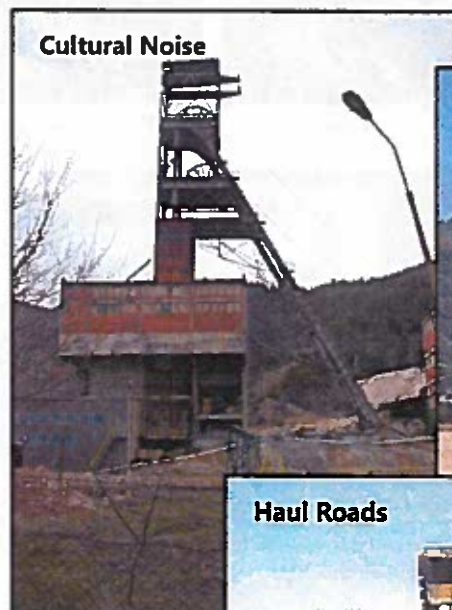
Exploring near mines by drilling alone can be expensive and time consuming. Thoroughly investigating highly prospective areas near the mine through traditional means can be challenging and the return on exploration costs relatively low. Traditional geophysical tools are limited by extreme cultural noise, prohibiting them from providing useful information, and are of little use near mines, except for borehole instrumentation.

Areas within the direct proximity of mine sites provide excellent geologic environments for additional reserves and new discoveries of satellite ore bodies. Measuring more data than traditional systems, Titan 24 has been deployed to a number of

mine sites to provide more information for drill targeting, ground condemnation, delineation, mine planning and extending mine life. Sophisticated digital signal processing and full waveform data enable excellent filtering capability, picking up small signals in the range of surrounding noise.

**TITAN 24 MINESITE SURVEYS:**

- Lac de Isles, North American Palladium
- Ren, Centerra Gold
- Red Lake Mine, Gold Corp
- San Nicolas, Teck Cominco
- Brunswick & Half mile, Noranda
- Voiseys Bay, Voiseys Bay Nickel
- Levack & Norman Mines, FNX Mining
- Fortitude, Newmont Mining
- Goldstrike, Barrick Gold
- Black Fox Mine, Apollo Gold
- Chelopech, Dundee Precious Metals
- Nickel South Rim, Falconbridge
- Boroo, Centerra Gold



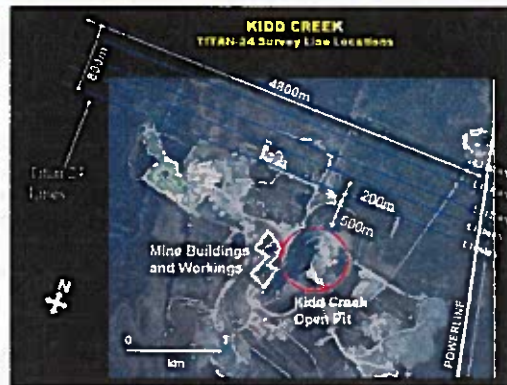
Distributed technology, digital signal processing and data over sampling are some of the features of Titan technology that allow the acquisition of information in culturally harsh environments.



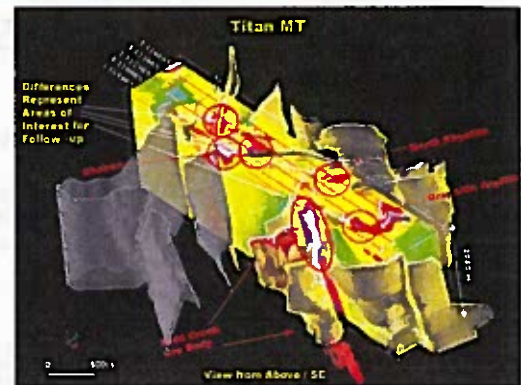
# Minesite Exploration - Kidd Creek Mine

## KIDD CREEK CASE STUDY:

The Titan 24 survey was to provide deep information to demonstrate system capabilities near the Kidd Creek mine in Northern Ontario. By mapping the subsurface to increase the geologic understanding outside of previously drilled areas, a focused program would reduce overall drilling costs by eliminating potential ground from exploration drilling.



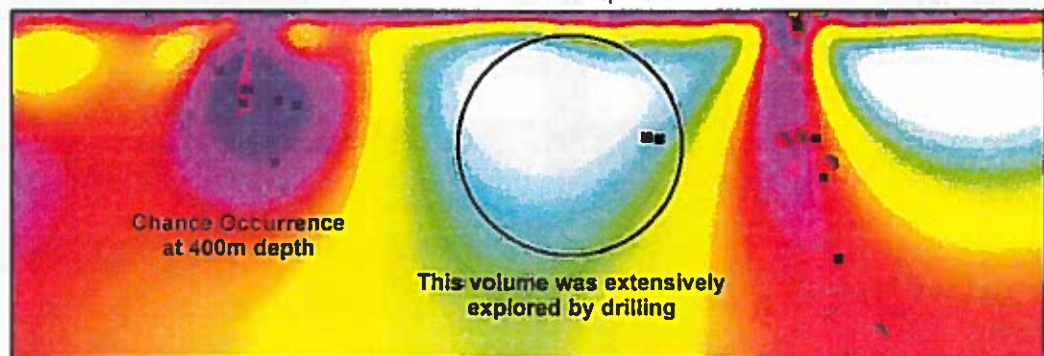
Titan 24 mine site survey near pit and power lines



3D Titan data super imposed on geologic model. Depth shown: 2000 metres.

## RESULTS:

The survey was able to penetrate thick (50 metre) conductive overburden. The blind test survey was successful at identifying 100% of the known targets previously drilled within the top 800 metres, and new target areas based on these results were identified for further exploration. A significant area where the survey indicated further investigation was not warranted was confirmed by hundreds of barren drill holes that had been drilled over 15 years at an estimated cost of over \$15,000,000.00



DC Resistivity section, line 10800 section shown to 800m depth, warm colours represent increased conductivity  
Data used by Permission: Noranda /Falconbridge

Titan has been deployed at a number of mine sites to provide more information for:

- drill targeting
- ground condemnation
- delineation
- local exploration
- geometric and volumetric studies pertaining to mine planning and mine life

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### PURPOSE:

The goal of the program was to test and possibly expand the reported resources between the existing pits to identify a new merged pit – known as the “Super Pit.” A comprehensive minesite exploration program was conducted to identify the potential for deep-seated, large porphyry deposits.

### CHALLENGES:

Several challenges existed at Copper Mountain. To date, conventional geophysics has been limited to detecting mineralization associated with copper porphyry ore bodies to depths of up to 100 metres. In addition, despite being highly prospective, the old mine workings, pits, talus and extreme culture such as powerlines presented real impediments to collecting high quality information.

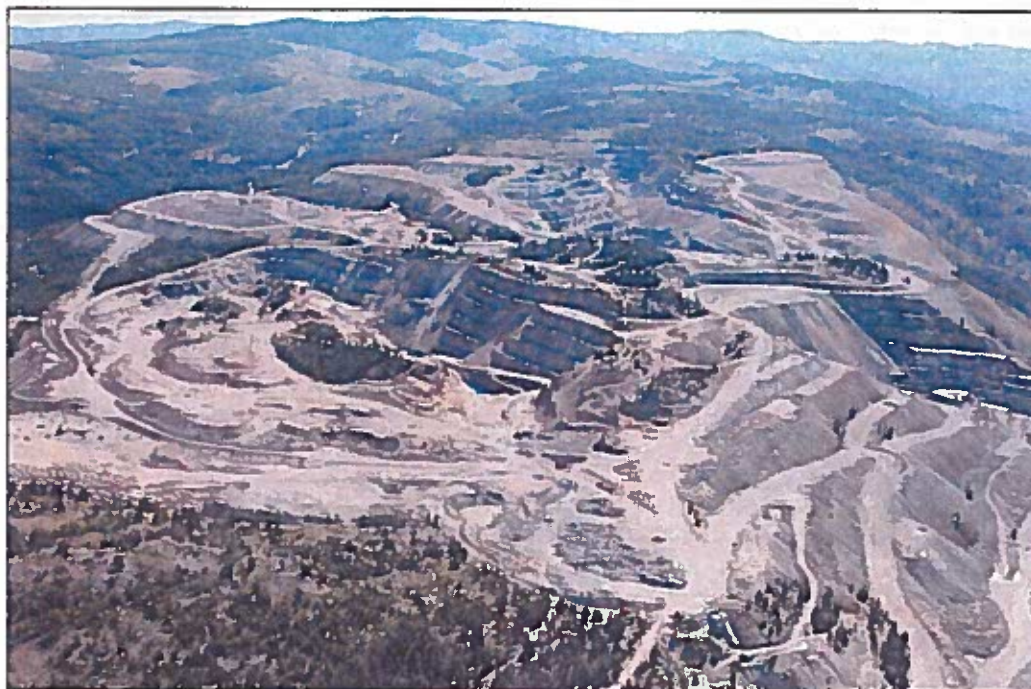
### SURVEY:

Copper Mountain Mining Corporation contracted a Titan 24 geophysical survey over an area 13 km<sup>2</sup> covering the existing pits. The survey covered an area that hosts a large proportion of the recently announced 2.9 billion lbs of copper and assisted in determining the potential for additional ore at depth, possibly beneath the existing pits or elsewhere in the property.

## Titan 24 Identifies Deep Seated Copper Porphyry Deposits

The Copper Mountain Property is located 15 km southwest of Princeton, BC, consisting of approximately 18,000 acres of prospective mining land. In 2007, the Company drilled approximately 44,000 metres, completing one of BC’s largest drill exploration programs in an effort to access additional mineralization at depth.

Copper Mountain Mining Corporation has a solid track record of exploration and development success. The Company owns 100% of the Copper Mountain Project with the goal of developing the project into a major copper and precious metal producer within the next three years.





# Copper Porphyry - Copper Mountain Mine, BC

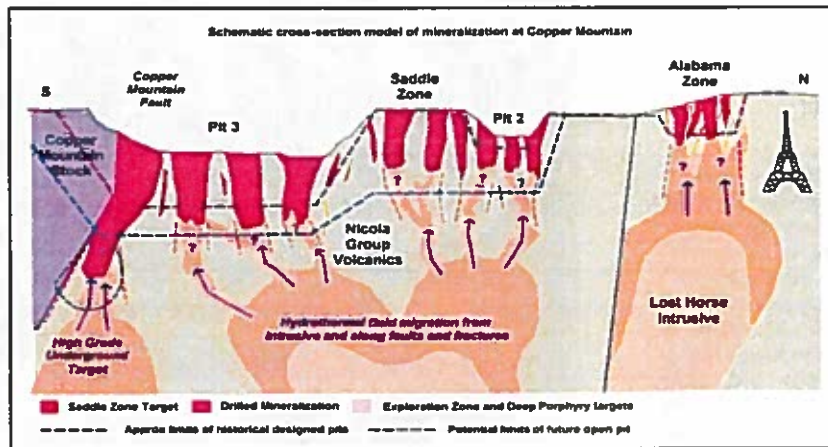
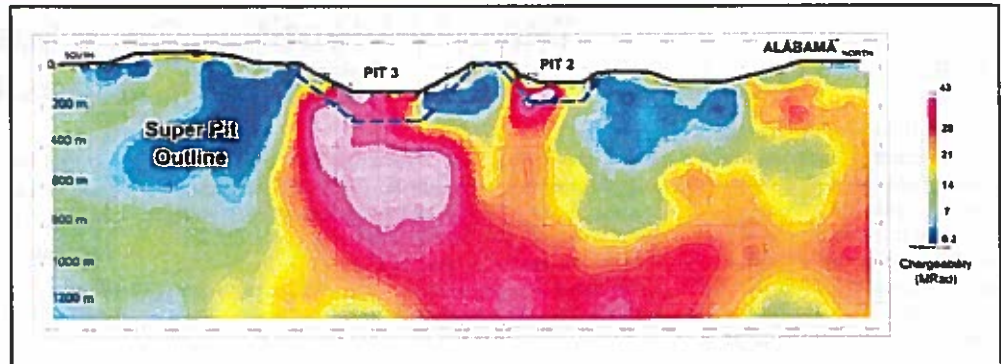
## TITAN 24 SOLUTION:

Titan 24 was designed to collect large volumes of data, simultaneously. Utilizing a large array configuration and advanced digital signal processing means that the system can often overcome many of the difficult challenges that have impeded conventional geophysics in brown field environments. The Quantec team that runs the system is highly skilled and trained to ensure the best possible results in these key, but difficult, environments.

## RESULTS:

“Currently known mineralization and the interpreted geological model for the area correlate well with the chargeability anomalies, providing confidence in the survey interpretation.”

A deep drill hole program targeted to test the large anomaly underneath Pit 3 has intersected significant mineralization 1200 feet below the current pit bottom.



## Other Mining Camps Explored with Titan 24:

- St. Elias Mines: Gralheira Deposit – 2000 metres
- Redstar Gold Corp: Newman-Todd Property – 2000 metres
- De Beers: Jwaneng Diamond Mine – 800 metres
- Falconbridge: Kidd Creek Mine (OMET Program) – 1500 metres

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## Targeting Deep Extensions in Vein Systems

### PURPOSE:

The Titan 24 survey provides deep imaging that would enhance the exploration efforts in the vicinity of the mine, providing drill targets related to satellite ore bodies. Mapping the resistivity and chargeability of the subsurface strengthens the geologic understanding outside of previously drilled areas, and reduces overall drilling costs by eliminating potential ground from exploration drilling.

### CHALLENGES:

Old mine workings, cultural noise, small targets, and deep complex environment.

### SURVEY:

The Titan 24 survey was executed on 5 lines, each 2.4 kilometres in length with line spacing at roughly 200 metres. The survey was carried out in December 2004, and results were made available early in the new year.

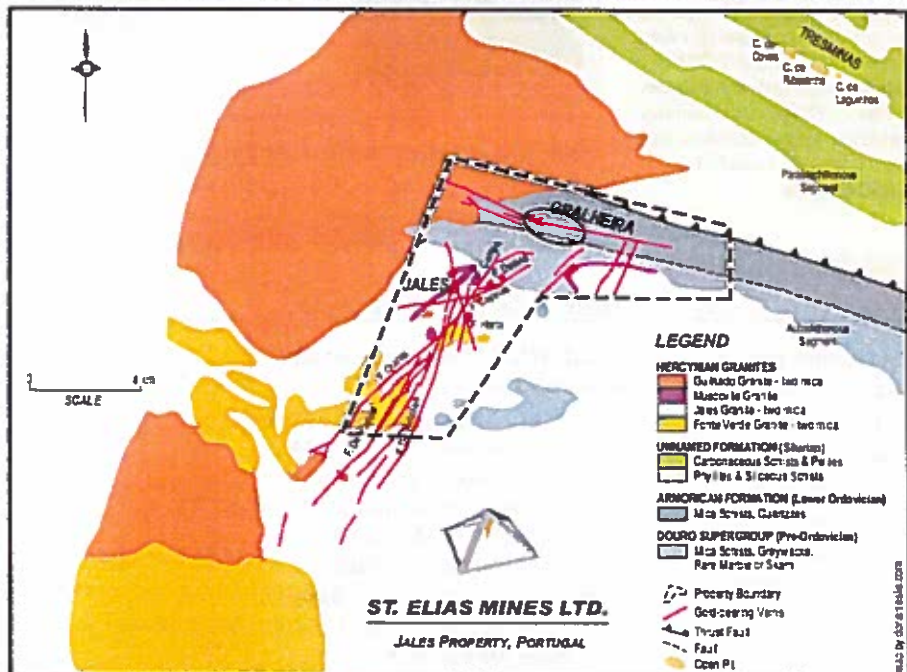
### RESULTS:

Titan surveys identified over 15 major chargeability-high and resistivity-low anomalies buried between depths of 100-750 metres consistent with vein-gold mineralized zones.

Anomalies are oriented along 5 linear trends (A-E) that extend across the property. Zone A corresponds to the main Gralheira vein system. It is mapped from surface to depths between 500-750 metres as an IP high feature. It shows potential deep extensions along L100W in particular, L700W and possibly 250E. Deeper ore shoots are implied between 400E and 700W along the baseline. Additional secondary veins are indicated north of the main Gralheira system.

The Gralheira deposit lies 700 metres north of the Jales mine in Northern Portugal and is contained within an extensive mineralized shear zone that extends for some 3,000 metres. Ancient Romans once mined both the Jales and Gralheira deposits, mining along a strike length of 2,000 metres at Gralheira. The main gold mineralization at Jales is hosted within a system of sub parallel veins ranging from 0.5 metres to 1.5 metres in width.

Jales was mined to a depth of around 620 metres and is known to be a mesothermal system, as is Gralheira. Geological theory tells us that mesothermal veins can have great depth extension. Previous drilling had tested the depth extent of the surface veins in the range of 150 to 300 metres. St Elias Mines was intent on proving that the system continued to depth and required a means for drill targeting.





# Gold - Gralheira, Portugal

## FOLLOW-UP DRILL RESULTS:

The drilling program on the Jales and Gralheira Gold properties consisted of 11 drill

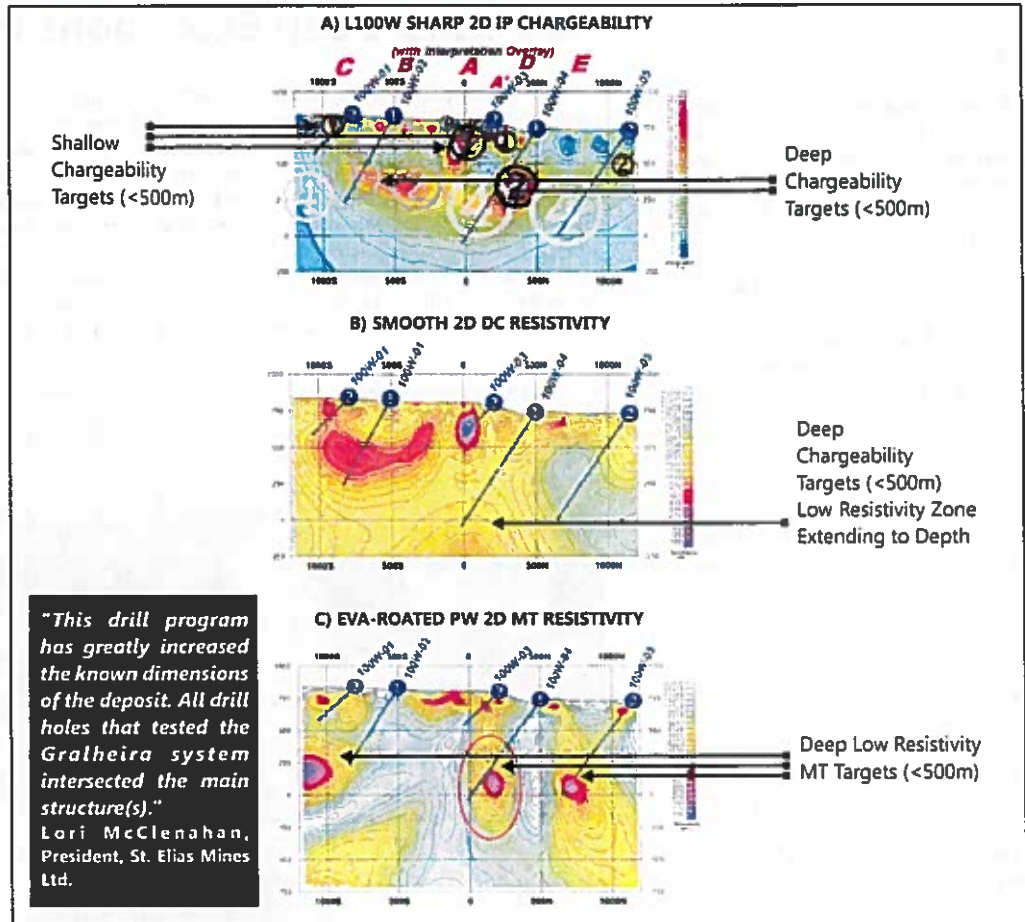
holes, some intersecting high-grade gold and silver mineralization. The drill program successfully achieved its primary objectives of significantly expanding the depth dimensions of the mineralized structures at Gralheira and confirming the TITAN 24 geophysical results. The drill program successfully intersected mineralization up to 511 metres below surface with most drill holes intersecting mineralization between 380 metres and 480 metres below surface. Prior to this drill program, the majority of holes previously drilled along the 2,000 metre strike length of Gralheira tested for mineralization only between the surface and a depth of 200 metres. The single deepest previous intercept was 300 metres below surface.

Targeting of the drill holes completed on the property was guided by the results of the TITAN 24 geophysical survey and by known geology. The TITAN 24 survey showed that the depth extent of the mineralized system could be in excess of 1,250 metres.

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## Titan Applications for Gold Exploration :

- Deep structural mapping, shears, faults etc.
- Disseminated sulphide distribution at surface to depths of 500 metres and more

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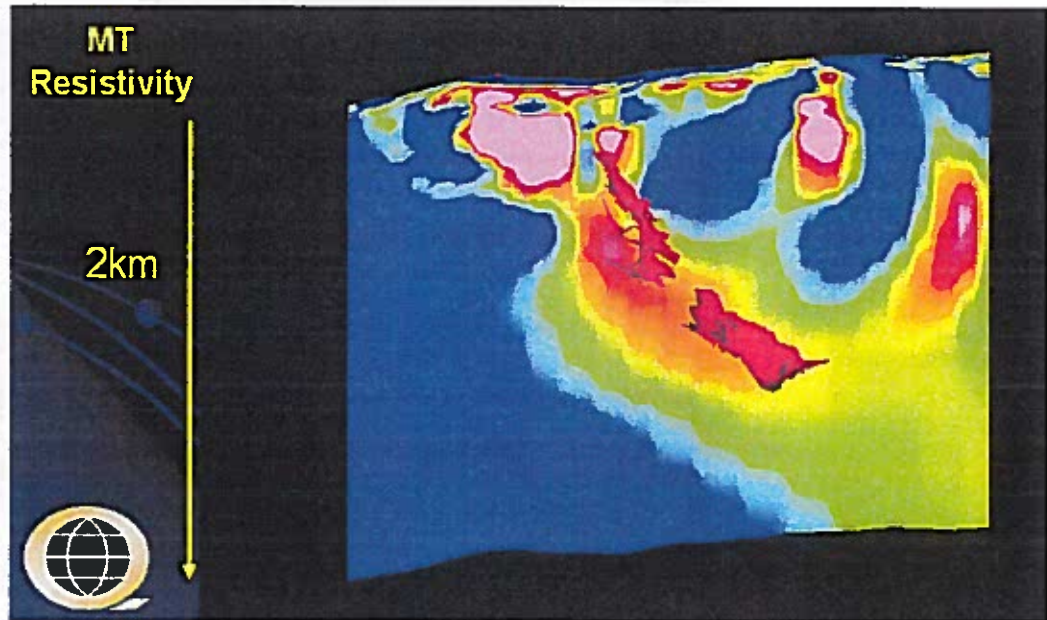


**Quantec Geoscience**

### Detect VMS Deposits at Depths of up to 1.5 Kilometres

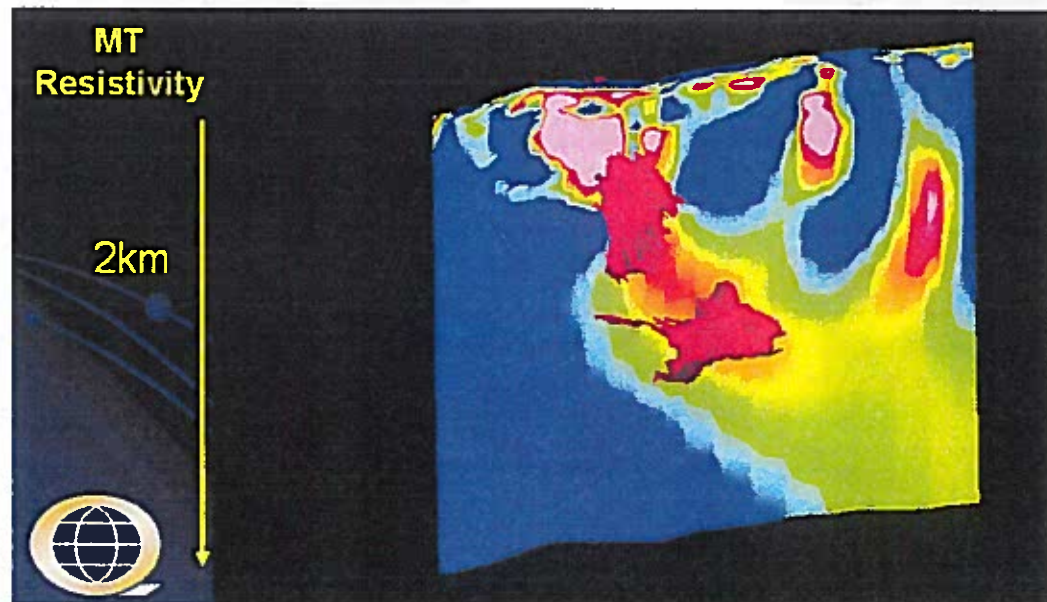
#### CHALLENGES:

Conventional geophysics had failed to detect and map to depth the largest of the three massive sulfide lenses found at the Half Mile base metal VMS deposit in New Brunswick. The deepest and largest sulfide lens was left undiscovered for decades. As a result the full value of the deposit was not known. Explorers need a tool that will detect and delineate to depth the full extent of VMS sulfide bodies. By knowing the full extent of mineralization explorers can focus on larger targets with larger tonnage potential.



#### RESULTS:

Titan 24 detected and mapped the vertical extent of the Half Mile base metal VMS deposits in New Brunswick, to a depth of over 1500 m. As a result Titan 24 was able to map the largest and deepest massive sulfide lens that was discovered several decades after the initial discovery of the near surface zone. By mapping the entire vertical extent of the VMS deposits, explorers are able to aim drilling at the largest targets with the greatest tonnage potential early in their exploration program.

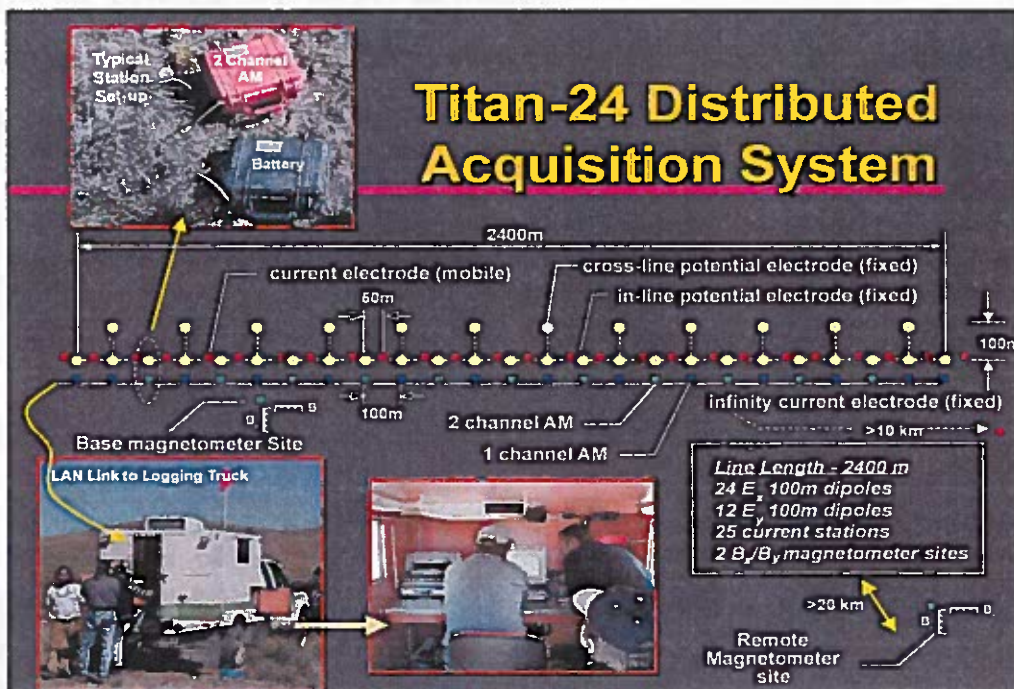




# VMS Exploration- Half Mile

## TITAN 24 SOLUTION:

Titan 24 enables exploration of prospective volcanic terrains to great depths beyond the limit of conventional geophysics. Titan 24 can detect base metal VMS deposits below 300 metres and discriminate large targets with high tonnage potential from smaller less prospective targets. By mapping prospective targets in 3D, Titan 24 provides explorers an indication of the shape, size and vertical and lateral extent of any potential VMS deposits.



Titan 24 MT & IP Distributed Array Survey



## Other VMS Camps Explored with Titan 24:

- Matagami, Quebec
- San Nicholas, Mexico
- Joutel, Quebec
- Val D'Or, Quebec
- Timmins, Ontario
- Brunswick Base Metal Mining Camp, New Brunswick

## About Quantec

Quantec Geoscience Ltd. has been helping with discovery for over 20 years.

Our offices throughout the world allow access to a collective knowledge database of thousands of projects with practically all possible geophysical surveys.

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