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Ministry of Forests, Mines and Lands
BC Geological Survey

Assessment Report
Title Page and Summary

TYPE OF REPORT [type of survey(s)]:

TOTAL COST: $128,046.77

AUTHOR(S): Thomas H. Carpenter, B.Sc., P.Geo.

SIGNATURE(S): *Original Signed by Author*

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S): N/A

YEAR OF WORK: 2011

STATEMENT OF WORK - CASH PAYMENTS EVENT NUMBER(S)/DATE(S): 5036279 September 30, 2011

PROPERTY NAME: Royalle

CLAIM NAME(S) (on which the work was done):
548801, 548802, 548803, 580522, 598223, 598226, 608081, 630203, 630223, 630243, 631123, 710782, 836890, 837873, 837874, 838202

COMMODITIES SOUGHT: Gold, silver, copper

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN: 092JNE011, 013, 014,015, 036, 043, 044, 143 and 145

MINING DIVISION: Lillooet

NTS/BCGS:

LATITUDE: 50 ° 42 ' 00 " **LONGITUDE:** 122 ° 39 ' 00 " **(at centre of work)**

OWNER(S):

1) John A. Chapman (50%)
2) Gerald Carlson (50%)

MAILING ADDRESS:

18 - 1480 Foster Street
White Rock, BC, V4B 3X7

1740 Orchard Way
West Vancouver, BC, V7V 4E8

OPERATOR(S) [who paid for the work]:

1) Worthington Resources Ltd
2)

MAILING ADDRESS:

817 - 938 Howe Street
Vancouver, BC, V6Z 1N9

PROPERTY GEOLOGY KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralization, size and attitude):
Fergusson and Cadwallader Groups, Coast Plutonic Complex, Bralorne Intrusions. Gold-silver-copper. Listwanitic alteration. The Property covers the southeastern extension of the Cadwallader Break, approximately 8 to 28 km from the Bralorne and Pioneer Mines. There are no past producers on the Property but the Property does include a number of mineral occurrences and prospects with a long history of exploration.

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS: 105, 8001, 8657, 8878, 10211, 11944, 13232, 14453, 14628, 15292, 15341, 15871, 16595, 16725, 19828, 29854

Next Page

TYPE OF WORK IN THIS REPORT	EXTENT OF WORK (IN METRIC UNITS)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
GEOLOGICAL (scale, area)			
Ground, mapping			
Photo interpretation			
GEOPHYSICAL (line-kilometres)			
Ground			
Magnetic			
Electromagnetic			
Induced Polarization			
Radiometric			
Seismic			
Other			
Airborne	408.5 line kilometres	All	$128,046.77
GEOCHEMICAL (number of samples analysed for...)			
Soil			
Silt			
Rock			
Other			
DRILLING (total metres; number of holes, size)			
Core			
Non-core			
RELATED TECHNICAL			
Sampling/assaying			
Petrographic			
Mineralographic			
Metallurgic			
PROSPECTING (scale, area)			
PREPARATORY / PHYSICAL			
Line/grid (kilometres)			
Topographic/Photogrammetric (scale, area)			
Legal surveys (scale, area)			
Road, local access (kilometres)/trail			
Trench (metres)			
Underground dev. (metres)			
Other			
		TOTAL COST:	$128,046.77

ASSESSMENT REPORT

On

ZTEM AIRBORNE SURVEY PROGRAM

ROYALLE PROPERTY

LILLOOET MINING DIVISION, BC

BCGS map 092J.067, 092J.068
092J.077 and 92J.078

Exploration on claims: 548801, 548802, 548803, 580522, 598223, 598226, 608081, 630203, 630223, 531123, 710782, 836890, 837873, 837874, 838202

Work filed on: 548801, 548802, 548803, 580522, 598223, 598226, 608081, 630203, 630223, 630243, 531123, 710782, 836890, 837873, 837874, 838202

NTS:	092J/10E
LATITUDE:	50° 42' N
LONGITUDE:	122° 39' W
OWNER:	John A. Chapman and Gerald G. Carlson
OPERATOR:	Worthington Resources Ltd.
CONSULTANT:	Discovery Consultants
AUTHOR:	Thomas H. Carpenter, PGeo
DATE:	December 15, 2011

TABLE OF CONTENTS

Page

1.0 SUMMARY 1
2.0 INTRODUCTION 1
3.0 PROPERTY LOCATION AND DESCRIPTION 2
4.0 ACCESSIBILITY, PHYSIOGRAPHY, CLIMATE, LOCAL RESOURCES AND INFRASTRUCTURE 6
5.0 EXPLORATION HISTORY 8
5.1 STANDARD (MINFILE 092JNE015) 9
5.2 ROYAL (MINFILE 092JNE014) 11
5.3 CHOPPER (MINFILE 092JNE036) 12
5.4 UPPER PIBITER (MINFILE 092JNE145) 12
5.5 BUTTE-IXL (MINFILE 092JNE011) 13
5.6 CONBRA (MINFILE 092JNE072) 14
5.7 FOX (MINFILE 092JNE153) 14
5.8 STAR MOUNTAIN (MINFILE 092JNE018) 14
5.9 ARCHIBALD (MINFILE 092JNE157) 14
5.10 SILICON CIRQUE (MINFILE 092JNE156) 14
5.11 PIEBITER CREEK AREA SKARN SHOWINGS 15
5.11.1 CHALCO 12 (MINFILE 092JNE044) 15
5.11.2 PIEBITER CREEK (MINFILE 092JNE143) 15
5.11.3 LOWER PIEBITER (MINFILE 092JNE043) 16
5.11.4 BRAMOOSE (MINFILE 092JNE013) 16
5.12 OPTION TO COVENANT RESOURCES 16
5.13 HISTORICAL SUMMARY 17
5.13.1 HISTORICAL GRIDS AND SUMMARY 17
5.13.2 HISTORICAL GEOPHYSICAL SURVEY SUMMARY 18
5.13.3 HISTORICAL DRILL PROGRAM SUMMARY 18
5.13.4 HISTORICAL UNDERGROUND WORKINGS SUMMARY 19
6.0 GEOLOGICAL SETTING
6.1 Regional Geology 19
6.2 Property Geology 25
7.0 ZTEM SURVEY 29
7.1 SURVEY PARAMETERS 29
7.2 SURVEY RESULTS 31
8.0 CONCLUSIONS 31
9.0 REFERENCES 32

10.0 STATEMENT OF COSTS 35
11.0 STATEMENT OF QUALIFICATIONS 36

LIST OF FIGURES

FIGURE 1 Property Location 4
FIGURE 2 Claim Locations (1:125,000) 5
FIGURE 3 Royalle Property Historical Mineral Occurrences (1:125,000) 10
FIGURE 4a Regional Geology (1:150,000) 23
FIGURE 4b Regional Geology Legend 24
FIGURE 5a Property Geology NW (1:40,000) 27
FIGURE 5b Property Geology SE (1:50,000) 28

LIST OF TABLES

TABLE 1 Tenure Description 3
TABLE 2 Historical Grids and Sampling on the Royalle Property 17
TABLE 3 Historical Geophysical Programs on the Royalle Property 18
TABLE 4 Historical Drill Program on the Royalle Property 18
TABLE 5 Historical Underground Workings 19

LIST OF PHOTOS

PHOTO 1 Cadwallader Creek Valley 8
PHOTO 2 Standard Creek Valley 25

APPENDICES

APPENDIX I Report on A Helicopter-borne Z-Axis Tipper Electromagnetic (ZTEM) and Aeromagnetic Geophysical Survey, Royalle Property, Gold Bridge, British Columbia

1.0 SUMMARY

The Royalle Property (“Property”) is located in the Lillooet Mining Division of British Columbia and comprises 16 Mineral Titles Online mineral claim tenures, which total 7,413 hectares. All of the tenures are owned jointly by G. Carlson and J. Chapman. Worthington Resources Ltd (”Worthington”) optioned the Property in 2010 and can earn a 100% interest. Worthington is the operator and carried out the exploration described in this report.

The Property includes several historical mineral occurrences and contains areas found to have anomalous values of gold, silver, copper, molybdenum, zinc and tungsten in the rocks and soils.

This report documents a 408.5 line-kilometre airborne ZTEM survey flown over the Property by Geotech Ltd (“Geotech”) The survey was based out of the Gold Bridge, some 20 km north-northwest of the property area and flown between May 22 and May 30, 2011. The report was compiled by Thomas H. Carpenter, PGeo, who has carried out previous exploration on the Property, visited the property in 2011, and authored an NI 43-101 report on the property.

The survey collected high-resolution electromagnetic data over the Property. These data allow a more thorough understanding of structural controls on the Property and will aid in directing future exploration.

2.0 INTRODUCTION

This report documents an airborne ZTEM (Z-axis Tipper Electromagnetic) survey flown over the Property by Geotech during the period May 22 to 30, 2011 from a base at Gold Bridge. The survey coverage comprised 408.5 line-km of which 396 line-km fell within the Property.

Results were presented, in late July, 2011, as stacked profiles and contour colour images at a scale of 1:50,000. No summary interpretation was included with the report, however 2D inversions were completed and are shown over 9 selected lines.

The total cost of the airborne geophysical ZTEM survey was $ 128,046.77.

3.0 PROPERTY LOCATION AND DESCRIPTION

The Property is located 175 km northeast of Vancouver, British Columbia, as is shown in Figure 1. The property is situated in the Lillooet Mining Division and is covered by map sheets 092J.067, 092J.068, 092J.077 and 092J.078. The northern limits of the Property are at 50° 44' north latitude, the southern at 50° 35' north latitude, the western at 122° 42' west longitude and the eastern at 122° 27' west longitude.

There are no surface landholders within the Cadwallader Creek valley within the Property, but in McGillivray Pass there is a surveyed lot, No. 8446, within mineral Tenure 548801, which is a commercial, helicopter-accessible ski lodge operated by Whitecap Alpine Inc (www.whitecapalpine.ca).

The Bridge River area is covered by the Lillooet Land and Resource Management Plan (“LRMP”), a strategic Land Resource Management Plan being prepared for a 1.1 million hectares (“ha”) area of the southwestern interior of BC. A draft of the plan of the Lillooet LRMP was released in July 2004 and continues to be the focus of ongoing government discussions with First Nations.

The LRMP coincides with the Lillooet Timber Supply Area within the Cascades Forest District. The Squamish-Lillooet Regional District covers most of the LRMP area and includes the communities of Lillooet, Gold Bridge, Bralorne and Seton Portage/Shalalth. The Property is located within the Cascades Forest District which is managed from the Kamloops Forest Service office.

The general area which includes the Property is subject to an aboriginal land claim by the N'Quatqua First Nation, located in D’Arcy, BC. This area is also within the Charleyboy Writ Area which is of interest to the Anahim, Toosey & Tslihqot’in First Nations, located in Alexis Creek, Riske Creek and Williams Lake respectively.

The Property comprises 18 Mineral Titles Online (“MTO”) mineral claim tenures, totalling 7,413 ha. All of the claims are owned jointly by Gerald G. Carlson (50%, held on behalf of KGE Management Ltd.) and John A. Chapman (50%) – (the “Optionors”). The claim details are listed in Table 1, below, and are illustrated on Figure 2.

Worthington optioned the Property as of October 15, 2010 and, under the terms of the agreement, as amended on November 14, 2010, can earn a 100% interest in the Property.

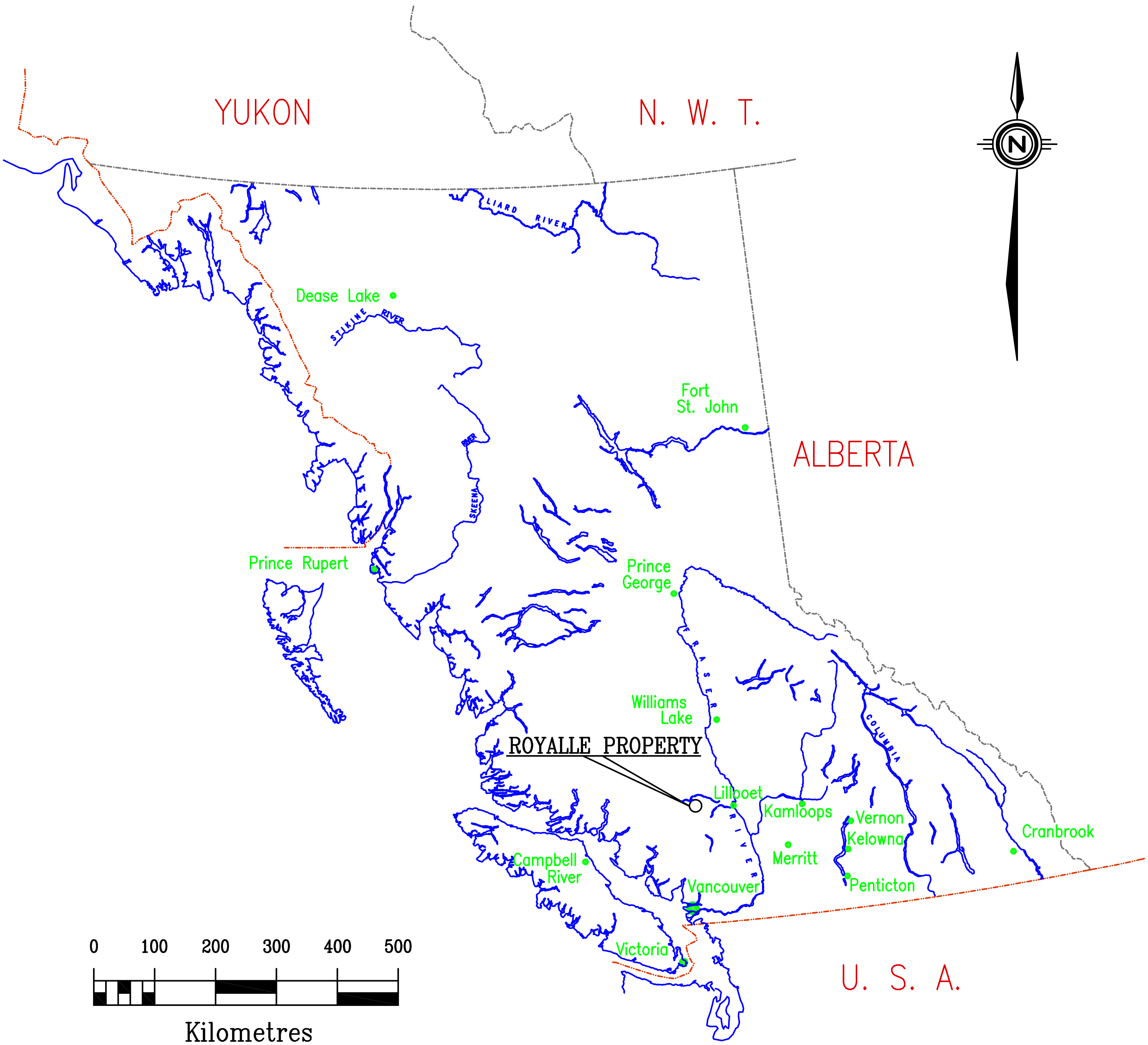
TABLE 1: Tenure Description

Tenure Number	Area (ha)	Registered Owner	Good to Date**
548801*	389.135	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
548802*	593.768	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
548803*	1903.592	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
580522*	491.475	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
598223*	511.929	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
598226*	286.769	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
608081*	511.759	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
630203*	307.299	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
630223*	327.873	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
630243	184.470	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
631123*	512.178	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
710782*	61.434	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
836890*	102.364	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
837873*	511.857	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
837874*	512.008	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
838202*	204.694	JA Chapman(104633) & GG Carlson(104271)[1]	2013/oct/31
Total:	7412.597		

[1] Tenure is owned jointly by Gerald G. Carlson (50%, held on behalf of KGE Management Ltd.) and John A. Chapman (50%).

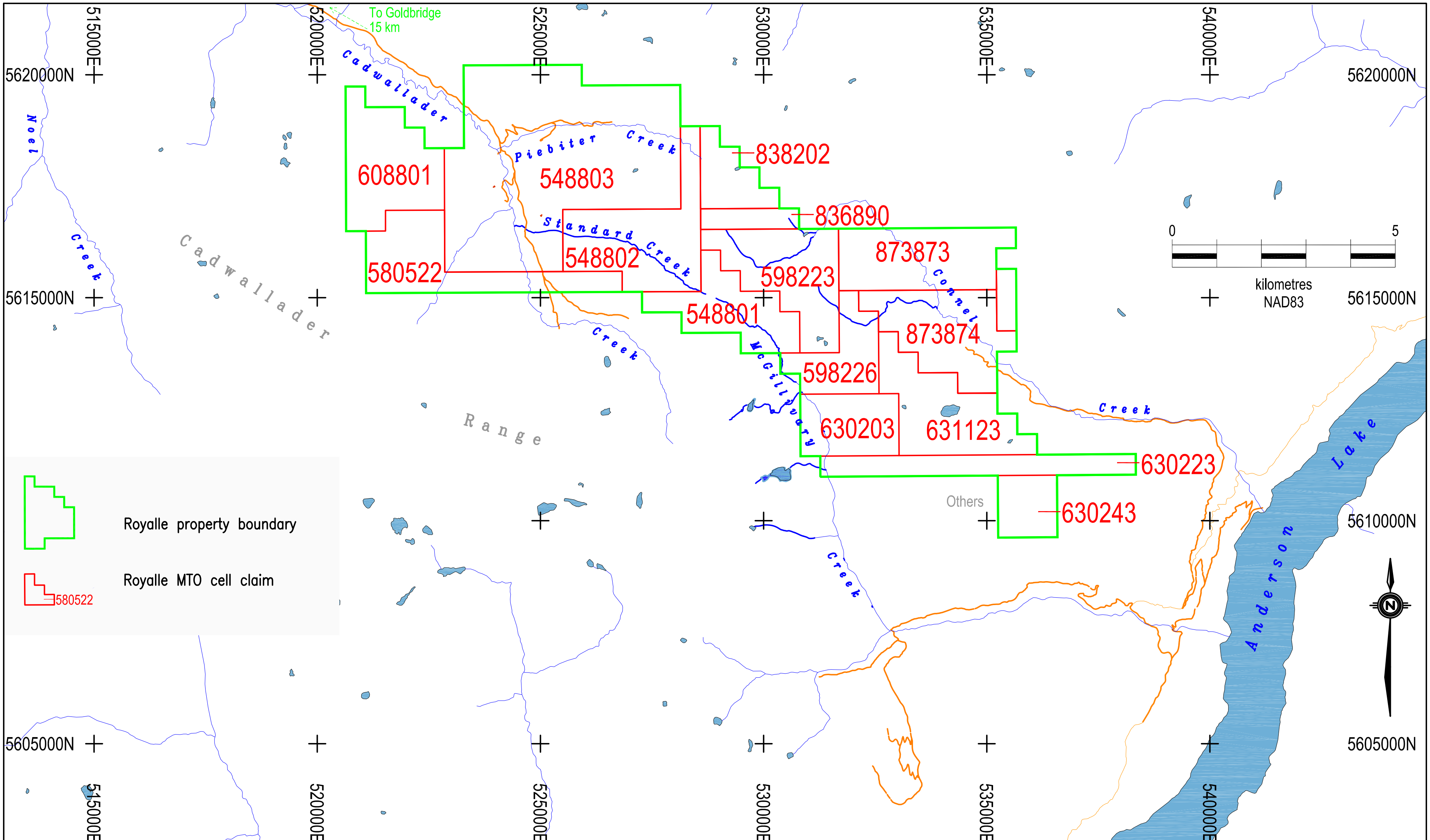
* Claim on which work was done

** Good to date is dependent on the acceptance of this report



DISCOVERY Consultants	Worthington Resources Ltd.
Royalle Property	Property Location

Date:	December 15, 2011	Project:	901	Scale:	1:10,000,000	N.T.S.:	092J NE	Mining Div:	Lillooet	Figure:	1



DISCOVERY Consultants			Worthington Resources Ltd.		
Royalle Property			Claim Locations		
Date: December 15, 2011	Project: 901	Scale: 1:125,000	N.T.S.: 092J NE	Mining Div: Lillooet	Figure: 2

4.0 ACCESSIBILITY, PHYSIGRAPHY, CLIMATE, LOCAL RESOURCES AND INFRASTRUCTURE

The Property is accessed by a gravel road from the small community of Gold Bridge which is located 90 km west of Lillooet on Highway 40. From Gold Bridge, the Bralorne Road is followed 4.5 km to the Kingdom Lake Forest Service Road (KLFSR) which is then followed east and southward over a high bench past the old Bralorne and Pioneer mine sites into the Cadwallader Creek valley. The original Cadwallader Creek road which provided historical access to this area is in poor condition and is not recommended for access.

The KLFSR appears to be moderately well-maintained as far as a Forest Service recreation camp site on Kingdom Lake but then slowly deteriorates to a single-lane dirt road by the time it reaches the Property, about 12 km from the Bralorne Road. Numerous old, deactivated skid-roads branch off the KLFSR and provide easy foot or ATV access to many lower parts of the Property; however all bridges over Cadwallader Creek have been removed so that access to the southwest side of the Property is problematic. Water for drilling is available year round from Cadwallader Creek and from many other tributaries, including Standard and Royal Creeks.

The Property straddles Cadwallader Creek which is part of the Bridge River drainage. This area is bounded on the west by the Coast Range and on the northeast by the Shulaps Range. The topography is rugged, except in the lower portions of the U-shaped Cadwallader Creek valley where slopes are more gentle and subdued. Elevations range from 1,310 metres on Cadwallader Creek to 2,350 metres on Royal Peak immediately southeast of Piebiter Creek. Outcrop exposure is generally good on the valley sides but is poor in the lower part of the valley due to an extensive cover of unconsolidated material.

Fluvial-glacial outwash deposits of silt, sand and gravel fill the valley bottom and form a number of terraces which now stand some tens of metres above the present Cadwallader Creek channel. The outwash deposits have been modified by colluvial slope processes on the lower slopes yielding a mixture of sorted and unsorted rounded to angular material. Unconsolidated materials found on the upper slopes appear to be mainly composed of colluvium and talus. Little or no glacial till was observed on the Property but the ubiquitous, large rounded boulders of granodiorite found throughout the valley bottom are thought to be glacial erratics.

Many of the lower parts of the Cadwallader Creek valley have been logged and replanted, primarily with spruce. Unlogged portions of the valley floor are heavily forested with mature spruce. There are significant areas of windfall near Cadwallader Creek. The upper valley slopes are covered with extensive forests of spruce and balsam, and pine is common in old burns.

The climate of this area is intermediate between the wet, coastal climate of the Coast Range and the dryer climate of the BC Interior. As such, the hot dry summers experienced in this area are similar to those of the interior dry belt, but the winter weather alternates between the cold dry air of the interior and the mild and wet weather of the coast. This often results in heavy snow accumulations and the snow pack commonly exceeds 1 m by late winter. Winter storms are often accompanied by significant avalanche danger.

Exploration work, consisting of geophysics and drilling has been carried out during the early winter on the Property, but in general, exploration in this area is best carried out between June and late October.

Limited facilities are available in the area, and those facilities that do exist are largely seasonal. Bralorne and Gold Bridge, with a combined population of less than 100, each have a restaurant and a motel. Gold Bridge has a small grocery store along with a gas station. Houses are available for rent in Bralorne on a seasonal basis. The closest town offering full services including a hospital, RCMP detachment, etc. is Lillooet.

Helicopters are available from Lillooet or Pemberton, and seasonally from Gold Bridge.

Photo1: Cadwallader Creek valley looking to the northwest towards Bralorne from the Upper Piebiter area. Roads and workings in lower right are Chalco area.

5.0 EXPLORATION HISTORY

The Bridge River Camp has been one of the most prolific mining camps in British Columbia. The initial activity in the area, placer gold mining, started in 1863 and led to the discovery of gold-bearing quartz veins in 1897 and to the eventual development of the Bralorne and Pioneer Mines along with several small mines. The focus of most exploration activity in this area and the subsequent mining production was the Cadwallader Break, which hosts the Bralorne and Pioneer Mines.

The Property covers the southeastern extension of the Cadwallader Break, approximately 8 to 28 km from the Bralorne and Pioneer Mines. There are no past producers located on the Property, but the Property does include a number of mineral occurrences (Figure 3) and prospects with a long history of exploration. The history of the Property is complicated by the fact that this area has rarely been explored as a whole, but rather as many small properties in a variety of overlapping configurations and explored by a number of different companies.

5.1 Standard (Minfile 092JNE015)

The Standard showing was explored by a number of trenches and two adits. Clothier (1933) reported that the Standard No. 2 Adit intersected gold mineralization from 65 to 86 metres from the portal. Exploration, supervised by the author, in 1987 (see below) has called into question these results.

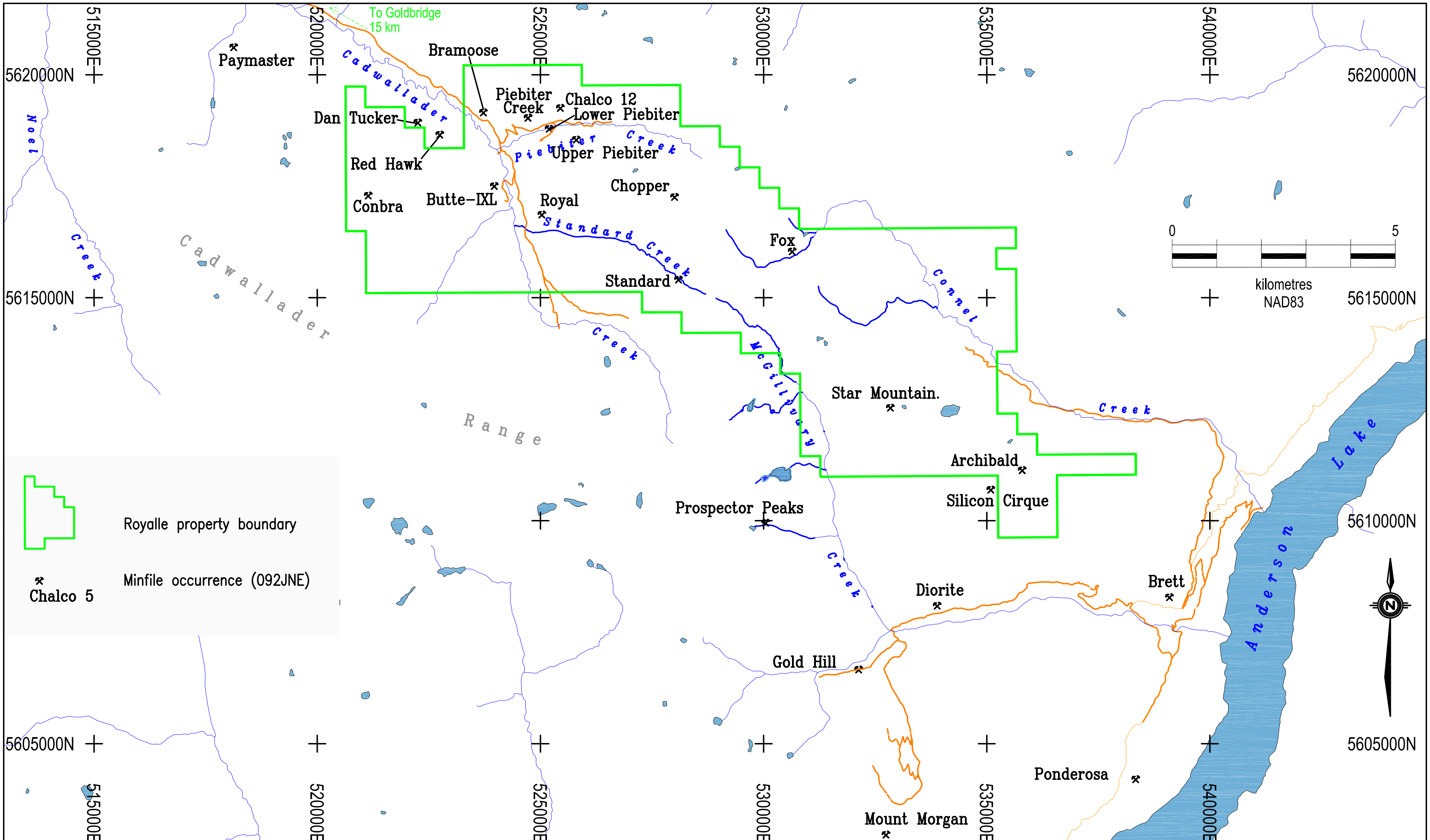
There was no further recorded work on the Standard until Hillside Energy (“Hillside”) explored this area in 1980 to 1982. A soil geochemical survey was carried out over this area but anomalies were never followed up.

Trans Atlantic Resources Inc (“Trans Atlantic”) acquired the property in 1984 and A & M Exploration (“A & M”) was hired to explore the property from 1984 to 1986.

Geochemical and geophysical surveys were completed and the Standard No. 2 Adit was partially rehabilitated and sampled. A three-hole core drill program in 1986 was unsuccessful at penetrating the highly fractured ground.

Trans Atlantic and Armeno Resources Inc (“Armeno”) undertook a large program in 1987 which included geochemical and geophysical (VLF/EM, magnetometer and resistivity) surveys, re-opening of the Standard No. 2 Adit, sampling and mapping the adit and drilling 8 diamond drill holes along strike of and down dip of the Standard No. 2 Adit. In general the results were poor; the best values obtained were 200 ppb Au (Sample 1115162) in S87-06 and 21 ppm Ag (Sample 1114284) in drill hole S87-02A (Carpenter and Haynes, 1988). The gold mineralization reported by Clothier (1933) in the Standard No. 2 Adit could not be reproduced despite extensive sampling (Carpenter and Haynes, 1988).

The Standard West area is centred at the Standard No. 1 Adit which is approximately 1,000 m northwest and on strike with the Standard No. 2 Adit. The adit is collapsed but a series of rusty seeps identify potential mineralized zones. A series of trenches (now overgrown) was excavated on the structure at about the same time as the adit was collared. Hillside carried out soil geochemical sampling as part of a large survey from 1980 to 1982. The 1987 program of Trans Atlantic and Armeno covered this area with soil geochemical, geophysical (VLF/EM and magnetometer) and geological mapping surveys.



DISCOVERY Consultants	Worthington Resources Ltd.
Royalle Property	Historical Mineral Occurrences

Date:	December 15, 2011	Project:	901	Scale:	1:125,000	N.T.S.:	092J NE	Mining Div:	Lillooet	Figure:	3

The Standard West Extension was explored in the 1987 exploration program of Trans Atlantic and Armeno to cover the area between the Standard West and Royal areas. It is located due west of the Standard West area and southeast of the Royal showing. A VLF/EM and magnetometer survey was undertaken.

5.2 Royal (Minfile 092JNE014)

In 1932 Cadwallader Gold Mines carried out small scale hydraulic/placer mining, trenching and from 1932 to 1934 established a short adit (Royal Adit) which exposed the veins. The veins are up to 1.5 m in true thickness. An area of vein stockworks, known as the Royal quartz vein zone, covers an area of at least 1,800 by 1,000 metres.

Hillside carried out soil geochemical sampling over the Standard West portion of the property as part of a larger survey in 1980 to 1982.

In 1984-1985 Trans Atlantic undertook a magnetometer and VLF/EM survey over the Royal area. In 1986, with Armeno, the company completed 2 diamond drill holes which intersected some quartz veins and minor mineralization.

In 1986, A & M, on behalf of Trans Atlantic and Armeno, identified an area of anomalous molybdenum in soils near the junction of Standard and Cadwallader Creeks and suggested the possibility of a porphyry molybdenum occurrence associated with peripheral lead-zinc-precious metal mineralization in the area.

The 1987 program of Trans Atlantic and Armeno completed an additional 2 diamond drill holes (665 m) which also encountered some quartz veins and minor mineralization. The presence of a molybdenum porphyry system, with peripheral or telescoped lead-zinc-precious metal mineralization is suggested.

A short caved adit, believed to date from the 1930s has been noted in the area described as the Royal/Piebiter Extension. This area is located to the north of the main Royal showing and southwest of the Upper Piebiter showing.

In 1986 this area was partially covered by the geophysical and geochemical surveys carried out on behalf of Trans Atlantic. This was followed up by magnetometer and VLF/EM geophysical surveys as well as geological mapping and prospecting.

5.3 Chopper (Minfile 092JNE036)

The earliest workings were several short adits completed in the 1910s and 1930s (Hazard and Empire Crown-granted claims). Cairnes mentioned the showing in his report on the area (Cairnes, 1937).

The vein was sampled and mapped in 1980 by Chopper Mines Ltd (Goldsmith, 1980). Trans Atlantic and Armeno completed a geological mapping of the vein's extension followed by a 3-hole diamond drill program and a surface vein sampling program in 1987. Hole C87-02 cut a 4.7-metre section (2.2 metres true width) averaging 255 g/t silver, including a 2-metre zone with assays of 458 and 362 g/t silver over one-metre sample widths (Carpenter & Haynes, 1988).

5.4 Upper Piebiter (Minfile 092JNE145)

The earliest recorded work on this showing was undertaken by Hillside in 1985. The company partially covered this area with a soil and rock sampling program that identified a gold geochemical anomaly in soils. The author, in 1987, panned flour gold from the most anomalous of the soil sampling sites at the upper end of the Upper Piebiter area, at the foot of a talus slope.

1n 1986, Armeno and Trans Atlantic drilled nine holes for a total of 1,504 metres. This drilling outlined a mineralized zone 15 to 35 metres wide (core length), which averaged 0.51 to 0.69 g/t gold with sections up to 3.63 g/t over a width of one metre and up to 5.69 g/t over 0.2 metres. Trace to minor gold values were noted to occur discontinuously over widths of up to 100 metres on the section containing drill holes P86-4, P86-5, and P86-7. This zone appeared to be open to the southeast (Allen et al., 1986).

Armeno and Trans Atlantic completed detailed geological mapping, geochemical survey and geophysical (VLF/EM and magnetometer) surveys of the mineralized structure in 1987. A 2.3-km road was also constructed in 1987 to the Upper Piebiter to allow track and 4-wheeled vehicle access to the showing.

Continued drilling in the Piebiter area in 1987-1988 successfully traced gold mineralization 300 m to the southeast of the previous 1986 drilling. Grades in excess of 1.0 g/t over one metre were found in eight of eleven holes drilled, with values as high as 5.28 g/t over one metre within a 9-metre intersection averaging 2.23 g/t gold in drill hole P87-02 (Carpenter & Haynes, 1988).

In 1989-1990 Armeno and Trans Atlantic completed an IP survey followed by 9 reverse circulation ("RC") drill holes for a total of 1,192 metres of drilling. The drill program intersected anomalous gold mineralization over a strike length of 600 m, identifying a zone which appears to be open both at depth and to the west. The best result obtained was 2.5 g/t gold with numerous intercepts less than 1 g/t gold. Details of this drill program were recorded in Assessment Report 19,828 (Collins and Sorbara, 1990).

No further work has been carried out on the Upper Piebiter showing, except in 2006 when Makepeace collected a small number of rock and core samples from outcrop and stored core during a brief property exam for Covenant (Makepeace, 2007).

5.5 Butte-IXL (Minfile 092JNE011)

In 1933 and 1934 the Butte-IXL adit was driven 245 m with an associated 50-metre shaft following 2 mineralized quartz veins. Cairnes in 1937 reported that the veins contained pyrrhotite, chalcopyrite and sphalerite with minor pyrite and galena and trace gold.

Hillside conducted geological and soil sampling programs in this area from 1980 to 1982 (Melrose et al., 1982).

Trans Atlantic and Armeno completed geological mapping, a geochemical survey and a geophysical (VLF/EM and magnetometer) survey in 1987. The results were not encouraging.

Immediately west of the Butte-IXL, on the Butte - X-Cal, trenches were excavated in 1933 and 1934.

X-Calibre Resources ("X-Cal") undertook geological and geochemical surveys, in 1984.

During the period 1985-88, Hudson Bay Exploration and Development ("HudBay") completed geological mapping and geochemical sampling (Lancaster, 1985).

Trans Atlantic and Armeno completed geological mapping, a geochemical survey and a geophysical (VLF/EM and magnetometer) survey in 1987. This was followed up by minor prospecting and a detailed VLF/EM survey over identified anomalous areas.

5.6 Conbra (Minfile 092JNE072)

In 1986 Peter Newman carried out a prospecting program over the occurrence area and collected a limited number of rock, soil and silt samples. No results were reported (Newman, 1986).

5.7 Fox (Minfile 092JNE153)

In 1985 D.P. Taylor carried out a program of rock sampling and pan concentrate sampling program in the vicinity of the Fox occurrence (Taylor, 1985). Nine rock samples and 10 pan concentrates were collected, the latter showing anomalies in silver emanating from the headwaters of Connel Creek and probably associated with the Chopper occurrence.

5.8 Star Mountain (Minfile 092JNE018)

In 1989, Teck Explorations Ltd ("Teck") carried out geochemical, geological and geophysical surveys.

In 1990, prospecting and sampling by Cogema Canada Ltd. 1.8 km northeast of the Star Mountain showing revealed anomalous nickel and chromium values from sheared, pyritic (quartz?)-carbonate altered ultramafic rocks (Schimann and Robb, 1991). Approximately 3.2 km northwest of the Star Mountain occurrence, grab samples yielded 0.93 and 0.91 g/t gold. The samples were taken from a 0.2-metre wide quartz vein in siltstone adjacent to feldspar porphyry. This occurrence is identical in description to the Star Mountain occurrence.

5.9 Archibald (Minfile092JNE157)

In 1990 the Archibald occurrence was part of a larger property that included the Star Mountain occurrence (see Section 6.8) and Silicon Cirque occurrence (Section 6.10). Work, that included geological and geochemical surveys, is detailed in BC Assessment Report 22,120 by Schimann and Robb.

5.10 Silicon Cirque (Minfile 092JNE156)

Quartz veins near Silicon Cirque and on Prospector's Peak (092JNE159) were explored by trenches and pits during the same period. Stream sediment and heavy mineral sampling were conducted in the vicinity of the Silicon Cirque showing by Silver Standard Mines in 1979 and X-Cal in 1983 (Mazur, 1983).

In 1983, Noranda Mines and Placer Development confirmed several anomalies. In 1985, mapping by HudBay confirmed the extension of the Cadwallader Break through this area. X-Cal drilled eight drill holes totalling 950 m in the South Fork area. Six of these drill holes tested the Switchback vein at depth. The exact locations of these holes are unavailable. One drill hole also tested the Gold Hill occurrence, off the present claim area to the southeast.

An electromagnetic (VLF-EM) conductor along South Fork Creek, west of the current claims, was also tested by a drill hole. Quartz stringers with pyrite and sphalerite were intersected adjacent to albitic dikes. Canada Tungsten Mining Corp re-logged the drill core in 1987 and several new gold soil anomalies were discovered along a major lineament.

In 1989, Teck optioned the property and conducted a comprehensive exploration program. In 1990, Cogema Canada Ltd ("Cogema") acquired the property and conducted exploration (Schimann and Robb, 1991).

5.11 Piebiter Creek Area Skarn Showings

In the Lower Piebiter area, in a series of showings that include the Chalco 12, Lower Piebiter, Piebiter Creek and Bramoose showings, metasediments of the Bridge River Complex, including limestone, chert and argillite, are altered to quartz-hornblende schist.

5.11.1 Chalco 12 (Minfile 092JNE044)

The Chalco 12 skarn-type deposit was initially reported in the 1948 BC Minister of Mines Report (Stevenson, 1948).

Hat Creek Energy Corporation ("Hat Creek") explored this area in 1979. Trans Atlantic and Armeno completed a geochemical survey and geophysical (VLF/EM and magnetometer) survey of all the skarn deposits in 1987.

5.11.2 Piebiter Creek (Minfile 092JNE143)

This limestone showing was initially reported in the 1948 BC Minister of Mines Report. A narrow scheelite-chalcopyrite-rich skarn was identified along the margin of a limestone lens in contact with volcanic rocks. The showing is primarily limestone with a 55% CaO content (Stevenson, 1948).

Hat Creek also explored this area in 1979.

Trans Atlantic and Armeno completed a geochemical survey and geophysical (VLF/EM and magnetometer) survey of all the skarn deposits in 1987.

5.11.3 Lower Piebiter (Minfile 092JNE043)

Scheelite, chalcopyrite and molybdenum were reported on the Lower Piebiter (Chalco 5 [L7700], Piebiter Creek, Lime Creek) showing in the 1948 BC Minister of Mines Report.

In 1969, an exploration program consisting of prospecting, mapping and drilling was completed on this showing. It defined a 50-m long by 4-m wide, copper-tungsten-silver-gold mineralized zone. Molybdenum was also noted in the skarn. Hat Creek explored this area in 1979 with a small drill program.

Trans Atlantic and Armeno completed a geochemical survey and a geophysical (VLF/EM and magnetometer) survey of all the skarn deposits in 1987. In 1988, two diamond drill holes (approximately 438 m) were completed on the Lower Piebiter to test coincident gold and arsenic anomalies. The drilling was unsuccessful in identifying the source of the anomalies. The best values in core were 250 ppb gold and 754 ppm arsenic (Carpenter and Haynes, 1988).

Trans Atlantic and Armeno completed one 95-m RC drill hole in 1990. The hole intersected pyrite concentrations but gold values were low (Collins and Sorbara, 1990).

5.11.4 Bramoose (Minfile 092JNE013)

Mineralization was first reported on the Bramoose (Peridot) showing in 1933. Gold and scheelite mineralization were reported by Cairnes in 1937.

Trans Atlantic and Armeno completed a geological mapping, geochemical and geophysical (VLF/EM and magnetometer) survey of this showing as part of their Chalco grid program in 1987.

5.12 Option to Covenant Resources

In February, 2007 the Optionors had optioned the Property (then called the Piebiter) to Covenant Resources Ltd (“Covenant”), Covenant’s exploration consisted of an Airborne AeroTEM System Electromagnetic & Magnetic (“AeroTEM”) survey by AeroQuest International (“AeroQuest”) in 2007-08, and a Mobile Metal Ion (“MMI”) soil geochemical survey in the fall of 2009. Later, Covenant dropped the option and the Property returned to the Optionors.

5.13 Historical Summary

Makepeace (2007) summarized data for the historical exploration activity directed at the known mineral occurrences within the area of the original Piebiter property and presented the summary in a series of tables. This is a convenient way to show the scale of activities that has been carried out in this area over the last half century; the summaries are shown in Tables 3, 4, 5 and 6. The data are organized by mineral occurrence and probably understates the amount of work carried out since the data list only work submitted for assessment credits and not the entire cost of the individual programs.

5.13.1 Historical Grids and Sampling Summary

A compilation has identified 55.8 km of grid lines in 10 grids from which 4,112 soil samples and 2,318 rock samples were collected. Because of the fragmented nature of these data, it is possible that some of these grids and the locations sampled were duplicated by subsequent programs carried out by different companies.

Table 2 - Historical Grids and Sampling on the Royalle Property

Mineral Occurrence	Line Km	Soil Samples[1]	Rock Samples[1]
Standard	15.9	123	549
Standard West	8.5	136	10
Standard West Extension	5.9	?	?
Royal	1.4	50	?
Royal - Piebiter Extension	-	?	?
Chopper	1.2	?	5
Upper Piebiter	4.1	186	22
Butte-IXL	8.3	294	4
Butte - X-Cal	3.2	?	?
Conbra	-	10	18
Fox	-	-	9
Star Mountain	-	*	*
Archibald	-	*	*
Silicon Cirque	4.35	3101*	1701*
Lower Piebiter	2.9	212	?
Butte-IXL/Royal		124**	
Total	**55.75**	**4,236**	**2318**

[1] Makepeace (2007) states that the number of samples collected was probably far in excess of the numbers recorded.
* Totals as reported by Teck and Cogema and includes numbers for Silicon Cirque, Star Mountain, Archibald and zones outside the present claims.
** MMI samples in the Cadwallader Creek valley bottom between the Butte-IXL and Royal occurrences.

5.13.2 Historical Geophysical Survey Summary

A large number of geophysical surveys has been carried out over the various grids on the Property. The following table is a compilation of some of the larger programs carried out during the period 1984 – 1990.

Table 3 - Historical Geophysical Programs on the Royalle Property

Mineral Occurrence	AeroTEM	VLF/EM	Mag	Resistivity	IP
Standard		1984-6	1984-6	1987-8	1986
Standard West		1987	1987	-	-
Standard West Extension		1987	1987	-	-
Royal		1984-7	1984-7	-	1986
Royal - Piebiter Extension		1987	1987	-	-
Upper Piebiter		1987	1987	1990	1990
Lower Piebiter		1987	1987	1990	1990
Butte-IXL		1986-7	1986-7	-	-
Butte - X-Cal		1986-7	-	-	-
Silicon Cirque*		1989	-	-	-
Property-wide	2007/08				

* Includes areas of Silicon Cirque, Star Mountain, Archibald and areas outside the Property

5.13.3 Historical Drill Program Summary

A total of 8,752 m of drilling in 48 diamond drill holes and an additional 1,287 m in 10 percussion holes have been tabulated.

Table 4 - Historical Drill Programs on the Royalle Property

Mineral Occurrence	Diamond Drill		Percussion	
	Number	Metres	Number	Metres
Standard	12	1,457	-	-
Royal	4	883	-	-
Chopper	3	1,120	-	-
Upper Piebiter	26	4,759	9	1,192
Lower Piebiter	2	433	1	95
Gold Hill*	1	100+	-	-
Total	**48**	**8,752**	**10**	**1,287**

*MINFILE showing and main part of drill program outside the Property

5.13.4 Historical Underground Workings Summary

Makepeace (2007) has found that there was at least 589 m of underground workings in 9 adits, along with a 50-metre deep shaft. Most of these workings were exploratory in nature rather than developmental and were driven on narrow quartz veins by prospectors in the 1930s looking for gold. The majority have since collapsed and are not accessible for sampling.

Table 5 - Historical Underground Workings on the Royalle Property

Mineral Occurrence	Adits		Shafts	
	Number	Metres	Number	Metres
Standard	1	340	-	-
Standard West	1	4	-	-
Royal	1	?	-	-
Royal - Piebiter Extension	1	?	-	-
Lower Piebiter	1	?	-	-
Butte-IXL	1	245	1	50
Butte/X-Cal	3	?	-	-
Gold Hill*	1	?		
Total	**10**	**589**	**1**	**50**

* Showing located outside claim boundary but one adit located within the Property

6.0 GEOLOGICAL SETTING

6.1 Regional Geology

The geology of the Bralorne - Gold River area includes an assemblage of Paleozoic, Mesozoic and Tertiary volcanic and sedimentary rocks and igneous intrusions. This area lies at the western margin of the Intermontane Belt where it abuts against the Coast Plutonic Complex to the west. A generalized geological map is illustrated in Figure 4.

The Bridge River area is on the boundary between the Cache Creek and Stikine terranes. These terranes were accreted to the North American craton in Middle Jurassic time. The Tyaughton Trough is a major subsidence marine sedimentary basin that developed from Late Jurassic to Middle Cretaceous time. The western margin of the trough was uplifted and the subsequent erosion exposed the Coast Plutonic Complex in Early Cretaceous time.

Late Cretaceous and Tertiary age structural activities include major uplifting, thrust faulting and strike-slip faulting with intermittent magmatic intrusions. A system of northwest-trending faulting developed at this time dominated by the Yalakom Fault transecting the Tyaughton Trough. Block faulting and further magmatic intrusions followed the strike-slip faulting.

The Cadwallader Break is the fracture system on which the major mines in the Bridge River Mining Camp are located. Fault slivers within the zone include diorite, greenstone, chert, ultramafic and clastic sedimentary rocks. The fault system is approximately 50 km in length and its southeastern extension bisects the Property. The movement and displacement of the Cadwallader Break is complex and unclear, especially in the area of the Property where it is believed to occupy the area of Cadwallader Creek and, as a result, is masked by Quaternary deposits.

The Cadwallader Break strikes northwesterly and dips steeply to the southwest in the Property area but at the Bralorne Mine the Cadwallader Break changes orientation and strikes northerly with a westerly dip. This deflection may have reactivated an older thrust fault (Fergusson Fault) that created a wedge shaped lens of rock which in turn created major tension fractures and shears in the wedge. The majority of the producing mines in the Bridge River Camp are within this wedge.

Other such wedges may occur along the Cadwallader Break creating similar facture patterns and hence mineral potential. The area at the junction of Cadwallader Creek from Piebiter Creek to Standard Creek for example, based on airborne geophysical data, exhibits the offsetting of geological features and thus the potential for tension fractures and shears.

The oldest rocks in the area are the Paleozoic age Fergusson Group comprising ocean-floor ribbon cherts intercalated with graphitic argillite, greenstone and thin limestone layers (Church, 1996). Quartz veinlets are common within the cherts. This unit is sometimes referred to as the Bridge River Complex (Potter, 1983). A chloritic/quartz-rich mica schist is associated with the Fergusson Group rocks and occurs near the contact with the Bendor Pluton (at the northern edge of the Property) and with the contact of the Coast Plutonic Complex.

The Triassic age Cadwallader Group is an island-arc assemblage which was accreted to the Bridge River Complex. The oldest unit within the Cadwallader Group is the Pioneer Formation. This unit is primarily a basaltic volcanic sequence with minor small limestone lenses and tephra beds. The Pioneer Formation is characterized by pillow lavas, volcanic breccias and massive flows and sills. The overlying Noel Formation includes thin-bedded argillite, chert, conglomerate and minor greenstone and thin-bedded turbidites. The Hurley Formation is the youngest unit in the sequence and comprises green, brown and black argillite and cherty argillite. Intercalated with the argillite are gritty siltstone, sandstone, conglomerate and fossiliferous limestone lenses.

Above the Bridge River/Cadwallader sequences the Jurassic/Cretaceous age Relay Mountain and Taylor Creek Groups were deposited as part of the Tyaughton Trough. The Relay Mountain Group comprises a series of fossiliferous shales, siltstones and greywackes. The Taylor Creek Group is a distinct sequence of pebble and boulder conglomerates with minor siltstone and shale layers.

The Tertiary age Big Sheep Mountain volcanic rocks are present only as a few minor outliers of felsic lava and breccia.

The youngest rocks in the area are the Miocene age Chilcotin Group basalt lavas of which small remnants remain due to major uplift of the coast range and subsequent erosion.

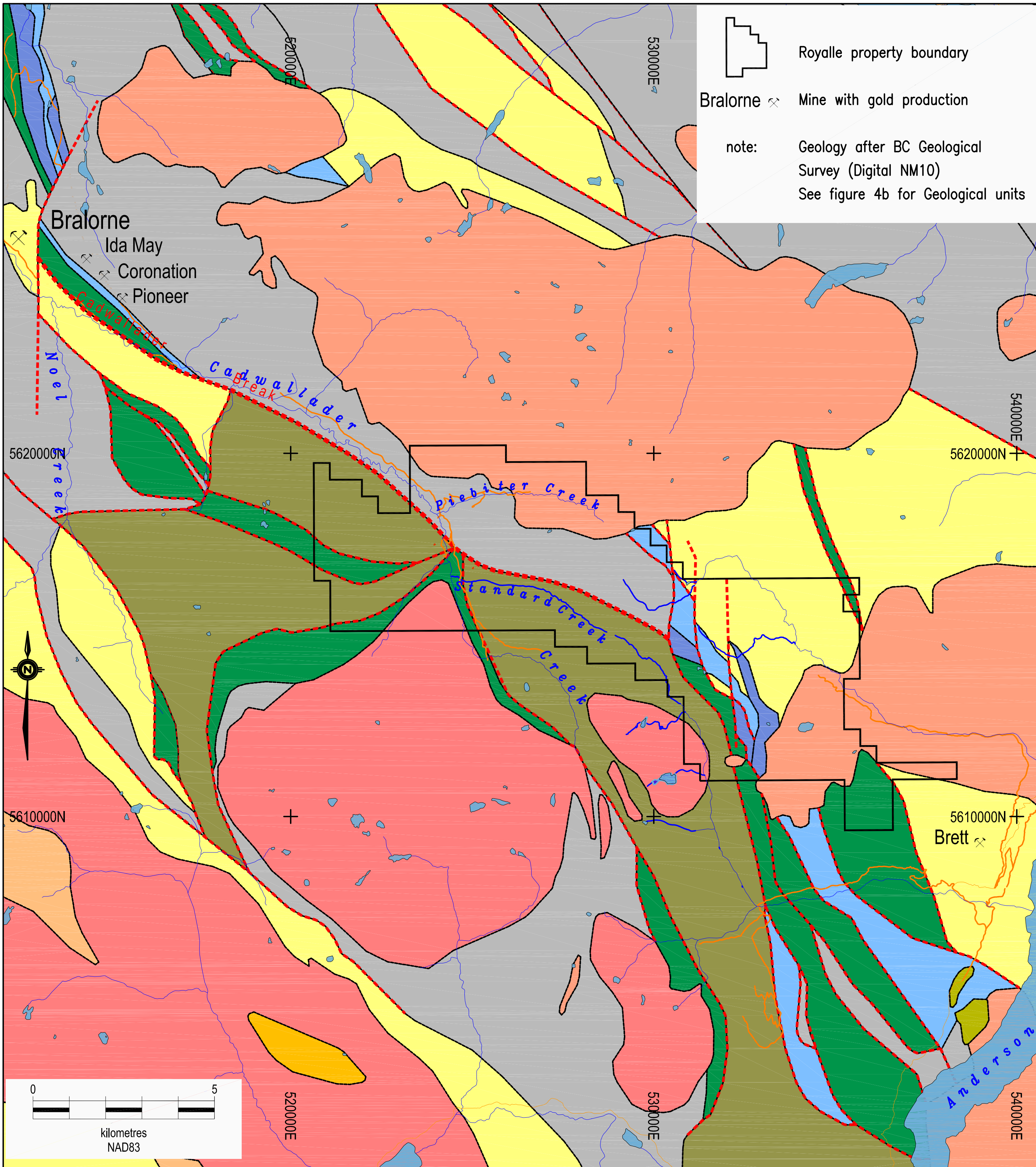
The oldest intrusions in the area are the Permian Bralorne Intrusions. These gabbroic to dioritic intrusions occur along major faults and are sometimes accompanied by ultramafic bodies. Also occurring are small granitic stocks.

There are a large number of ultramafic, intrusive bodies in the Bridge River area. These ultramafic rocks are a series of serpentinite and talc-carbonate rocks of dunite, pyroxenite and peridotite composition that are associated with deep-seated faults in the area. The largest ultramafic bodies are the Shulaps Complex and the Sunshine and President Ultramafics. Some of these bodies have been interpreted as ‘alpine-type’ and ophiolitic. The ultramafic rocks are thought to be of Cretaceous age. Chromite and listwanites are associated with this unit. Listwanite is a term long used by Soviet geologists working in the Ural goldfields of Russia (Goncharenko, 1979, Kuleshevich, 1984) that is now used in Europe and North America. It describes a mineralogical assemblage that results from the carbonatization of serpentinized ultramafic rocks and represents a distinctive alteration suite that is commonly associated with quartz-carbonate lode gold deposits. In British Columbia, as in the Mother Lode District of California, listwanites are most commonly recognized within and near major fault zones cutting Paleozoic and Mesozoic oceanic and island arc accretionary terranes that have been altered by tectonism, metamorphism and plutonism

The Late Cretaceous/Early Tertiary age Coast Plutonic Complex forms the southwest edge of the above sequence. This intrusive unit’s composition is soda granite to diorite and forms numerous plutons and smaller satellite intrusive stocks in the area. The Bendor Pluton (at the northern edge of the Property) and the Eldorado Pluton are thought to be late-stage events in the Complex’s history.

The youngest intrusion in the area is the Middle Eocene age Rexmount Porphyry. Crosscutting basic to felsic dikes in the area are related to this unit.

The older rocks of the area exhibit greenschist-grade metamorphism while younger rocks, although folded and faulted, tend to be metamorphosed only near contacts with major igneous intrusions.



DISCOVERY Consultants	Worthington Resources Ltd.
Royalle Property	Regional Geology

Date:	December 15, 2011	Project:	901	Scale:	1:150,000	N.T.S.:	092J NE	Mining Div:	Lillooet	Figure:	4a

Symbols

Dashed black line	Geological boundary
Dashed red line	Fault

Geology

Eocene	Olive yellow	Dacitic volcanic rocks
Late Cretaceous	Pink	Granodioritic intrusive rocks
Lower Cretaceous	Orange	Taylor Creek Group - Lizard Formation Coarse clastic sedimentary rocks
Late Cretaceous to Paleogene	Salmon	Granodioritic intrusive rocks
Jurassic to Cretaceous	Pale yellow	Cayoosh Assemblage Undivided sedimentary rocks
Lower Jurassic to Middle Jurassic	Light orange	Ladner Group Mudstone, siltstone, shale, fine clastic sedimentary rocks
Upper Triassic	Light blue	Cadwallader Group - Hurley Formation Coarse clastic sedimentary rocks
	Blue	Cadwallader Group - Volcanic Unit Greenstone, greenschist, and metamorphic rocks
Permian	Green	Bralorne - East Liza Complex Serpentinite ultramafic rocks
	Olive green	Chasm Creek Schist Serpentinite ultramafic rocks
Mississippian to Middle Jurassic	Grey	Bridge River Complex Marine sedimentary and volcanic rocks

note: Geology after BC Geological Survey (Digital NM10)

DISCOVERY Consultants							Worthington Resources Ltd.						
Royalle Property							Regional Geology Legend						
Date:	December 15, 2011	Project:	901	Scale:	none		N.T.S.:	092J NE	Mining Div:	Lillooet	Figure:	4b	

6.2 Property Geology

Allen et al. (1986) and Carpenter et al. (1988) report that the northwestern portion of the Property is underlain by rocks of the Fergusson Group, the Pioneer and Noel Formations of the Cadwallader Group, diorite of the Bralorne Intrusions, President Ultramafics and rocks of the Coast Plutonic Complex (Figure 5a).

The most common lithologies include chert, black argillite, quartz biotite schist, limestone, greenstone, ultramafic rocks, serpentinite and diorite. The greenstone includes massive layers, agglomerates and tuffs, with local metamorphic equivalents including biotite schist and phyllite, which may represent a more felsic unit.

The ultramafic rocks resist weathering and form a series of prominent knobs and cliffs which cut diagonally across the Property and may mark the location of one or more deep-seated structures. Other than these ultramafic outcrops and some outcrops exposed along stream-cut gullies, there is little bedrock exposure in the Cadwallader Creek valley floor.

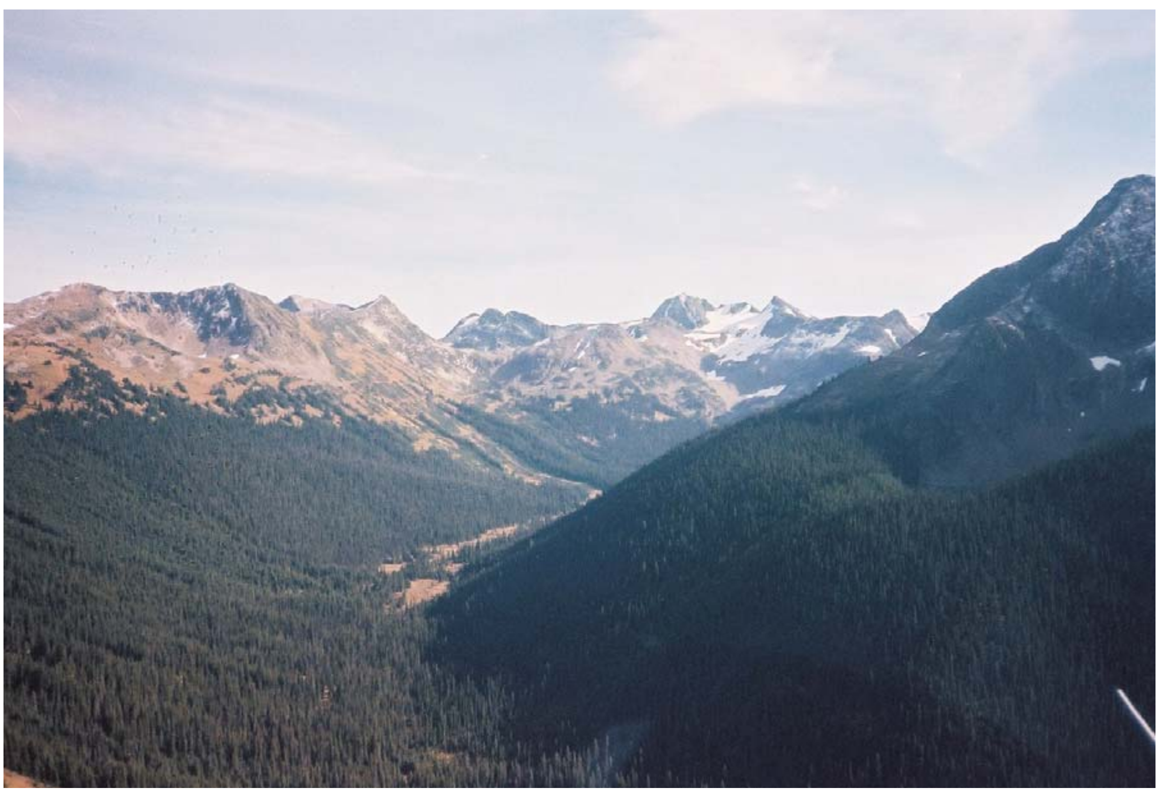


Photo 2: View up Standard Creek to the southeast from above its junction with Cadwallader Creek. The trace of the Cadwallader Break is believed to be on the left side of the valley.

The bedded and schistose rocks, exposed on the valley sides generally strike southeasterly with moderate to steep dips to the southwest. There appears to be some tendency toward a steepening of the dip to the southwest and together with a few steep, northeasterly dips, there is a suggestion of a tight syncline.

Figure 6 shows a cross-section of the geology of the Bridge River Camp at the Pioneer Mine (after Joubin, 1948). The geology and structures as shown on this section continue southeasterly onto the northwestern part of the Property.

The geology of the southern part of the Property is very similar to the Bralorne-Pioneer area. Schimann and Robb (1991) reported that the Coast Plutonic Complex occupies the area to the west of the Property and covers a small area in the southwest of it.

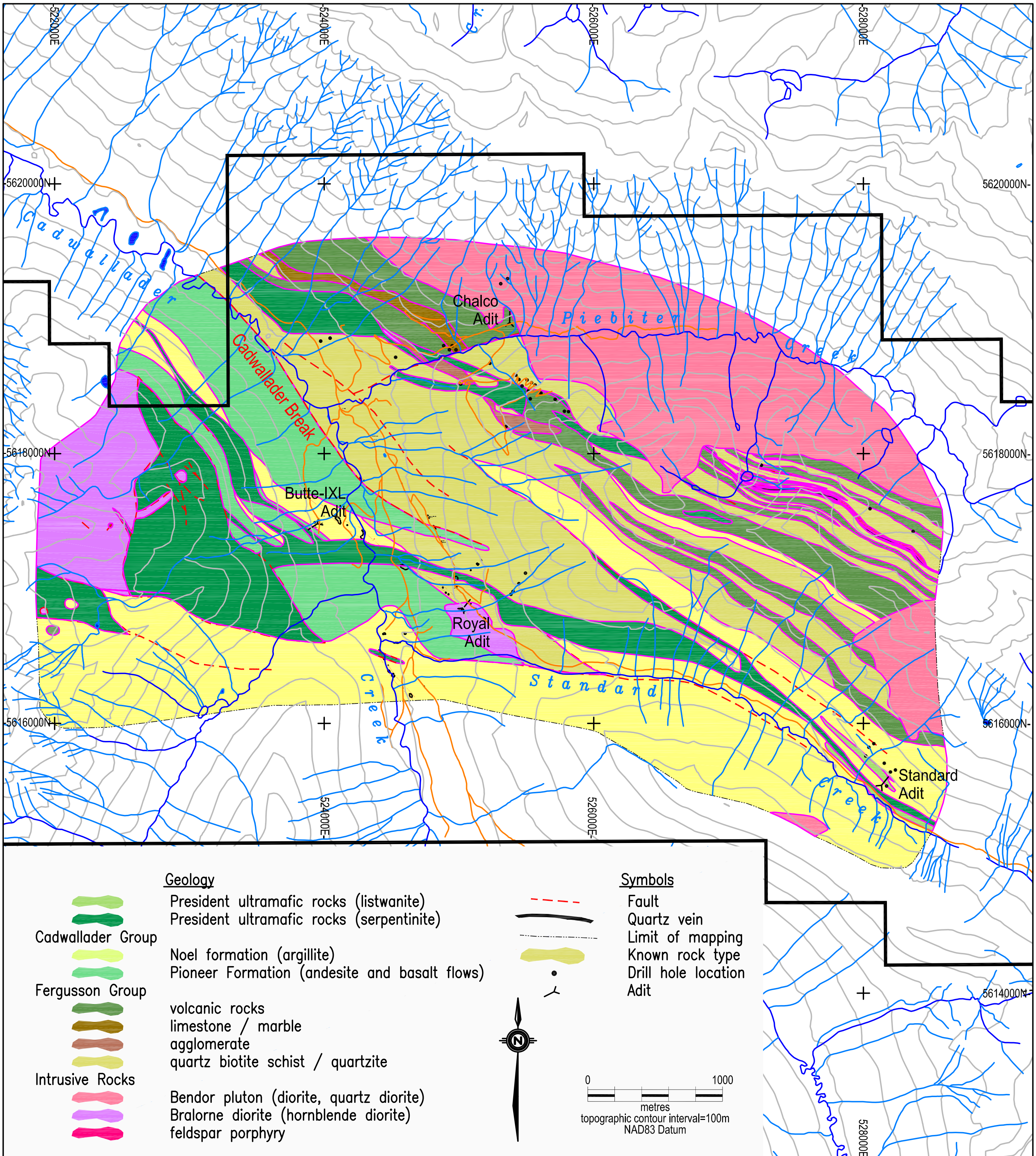
The rest of the Property is underlain by volcanic rocks and sediments of the Bridge River Complex and the Cadwallader Group accompanied by diorite to gabbro of the Bralorne Intrusions. These units are juxtaposed in a series of fault slices. The faults are commonly underlined by slivers and pods of ultramafic rocks which are frequently altered to serpentinite or listwanite.

The Bridge River Complex consists mostly of alternating chert and black more or less pyritic argillites with associated basalt and/or andesite, mostly pillowed.

The Cadwallader Group consists of mostly tuffaceous andesite, siltstone, and sandstone with some conglomerate. The andesitic tuffs grade into the siltstone. Both the Bridge River and the Cadwallader are slightly metamorphosed into lower greenschist facies.

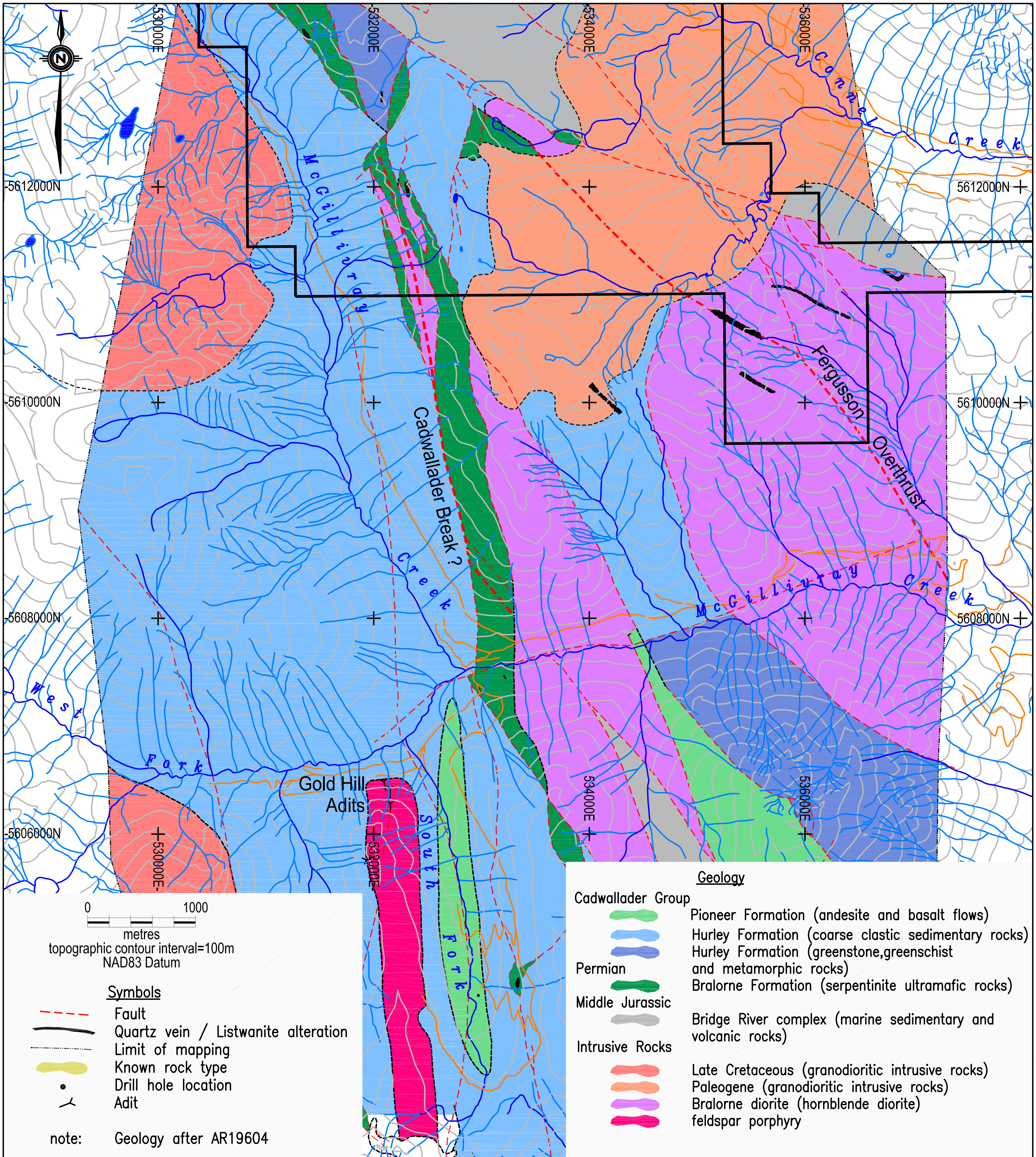
The Bralorne diorite is fine to medium grained with varying mafic contents. The mafic content and the grain size vary rapidly giving a heterogeneous, patchy aspect to the diorite, which is also frequently cut by small pyritic and/or pyrrhotitic shears. The diorite has been metamorphosed as well locally to lower greenschist facies.

The Bendor Intrusion comprises a medium-grained granodiorite and is probably intruding the Bralorne diorite although contact relationships have not been observed in the field.



DISCOVERY Consultants	Worthington Resources Ltd.
Royalle Property	Northwest Area Geology

Date: December 15, 2011	Project: 901	Scale: 1:40,000	N.T.S.: 092J.067,077	Mining Div: Lillooet	Figure: 5a



DISCOVERY Consultants	Worthington Resources Ltd.
Royalle Property	Southeast Area Geology

Date: December 15, 2011	Project: 901	Scale: 1:40,000	N.T.S.: 092J.067,077	Mining Div: Lillooet	Figure: 5b

7.0 ZTEM AIRBORNE GEOPHYSICAL SURVEY

Exploration carried out by Worthington on the Property in 2011 consisted of a ZTEM System Survey by Geotech of Aurora, Ontario over an area of 164 km^2.

The ZTEM Survey was carried out by Geotech during the period May 22 to 30, 2011 from a base at Gold Bridge. The survey coverage comprised 408.5 line-km of which 396 line-km fell within the Property.

Results were presented, in late July, 2011, as stacked profiles and contour colour images at a scale of 1:50,000. No summary interpretation was included with the report, however 2D inversions were completed over 9 selected lines.

7.1 Survey Parameters

The geophysical equipment used in the ZTEM survey comprised the ZTEM or Z Axis Tipper Electromagnetic system, an airborne electromagnetic system which uses the natural or passive fields of the Earth as the source of transmitted energy. The Earth and ionosphere, both conductive, act as a waveguide to “transmit” the source energy great distances. Due to the manner in which they propagate, these natural fields are planar and horizontal. Any vertical field therefore is caused by conductivity contrasts within the Earth. The vertical EM field is referenced to the horizontal electromagnetic (“EM”)field as measured by a set of horizontal base station coils.

ZTEM data are closely related to resistivity/conductivity mapping of the subsurface and is a passive electromagnetic technique with a theoretical exploration depth of over 2000 metres.

The system exhibits excellent resistivity discrimination and detection of weak anomalies due to the nature of the natural EM fields.

The survey was flown at a nominal height of 297 metres above the ground, with a nominal survey speed of 80 km/h for the survey block. This allowed for a nominal EM sensor terrain clearance of 227 metres and a magnetic sensor clearance of 242 metres.

Ancillary equipment for the ZTEM survey included a NovAtel CDGPS enabled Propak V3-RT20 navigation system, a Terra TRA 3000/TRI 40 radar altimeter, video recorder and a base station magnetometer (Geometrics G-859). Full-wave form streaming EM data were recorded at 36,000 samples per second. The streaming data comprised the transmitted waveform, and the

X component and the Z component of the resultant field at the receivers. A secondary acquisition system (RMS DGR-33) recorded the ancillary data at a rate of 10 samples per second.

For the ZTEM survey quality control consisted of the re-examination of all data by senior data processing personnel at Geotech. Attitude corrections were re-evaluated and re-applied on component by component, flight by flight, and frequency by frequency bases. Any remaining line to line system noise was removed by applying additional levelling corrections.

Due to mountainous terrain the flight elevations occasionally caused the aircraft's on-board radar to fall out of range. In such cases the digital elevation model was approximated using available software and the altitude was then recalculated.

The crossover polarity rule convention for ZTEM uses the right hand Cartesian rule (Z positive – up) that is commonly used for multi-component transient electromagnetic methods. For the southwest to northeast lines of the survey the sign convention for the in-phase Tzx inline component crossover is positive-negative pointing southwest to northeast for tabular conductors perpendicular to the profile. The corresponding Tzy component in-phase cross-over polarity is positive-negative pointing northwest to southeast (90 degrees counter clockwise to Tzx) according to the right hand Cartesian rule.

For the northwest to southeast lines of the survey the sign convention for the in-phase Tzx inline component crossover is positive-negative pointing northwest to southeast for tabular conductors perpendicular to the profile. The corresponding Tzy component in-phase crossover polarity is positive-negative pointing southwest to northeast (90 degrees counter clockwise to Tzx) according to the right hand Cartesian rule.

Conversely, tabular resistive bodies produce in-phase crossovers that are opposite in sign to conductors.

In a final processing step DT (Total Divergence) and PR (Phase Rotation) processing are applied to the multi-frequency in-phase and quadrature ZTEM data. This is due to the crossover nature of the Tipper Responses; these additional processing steps are applied to convert them into local maxima for easier interpretation. To present the data from both tipper components into one image, the Total Divergence parameter, termed the DT is calculated from the horizontal derivatives of the Tzx and Tzy tippers.

7.2 Survey Results

A full technical report of the survey, including coloured maps and profiles, is included as Appendix I.

8.0 CONCLUSIONS

The ZTEM airborne geophysical survey, combined with the earlier AeroTEM and MMI soil geochemical surveys have provided new information about the Property and these have the potential to identify exploration targets in the core area with poor outcrop exposure as well as in other, under-explored parts of the Property.

Respectfully submitted,

Original Signed by Author
____
Thomas H. Carpenter, PGeo
Discovery Consultants
Vernon, BC
December 15, 2011

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10.0 STAEMENT OF COSTS

1. Professional Services					
W.R. Gilmour, PGeo					
Report editing					
	0.5 days @	$750 per day		$375.00	
T.H. Carpenter, PGeo					
date: June, July & October, 2011					
Program supervsion, field visit, data analysis & report writing					
	4.5 days @	$750 per day		3,375.00	
				------------	$3,750.00
2. Personnel					
Office					
Drafting				1,500.00	
Data Compilation				385.00	
Secretarial				770.00	
				------------	2,655.00
3. Expenses					
Lodging & Meals				108.25	
Office				100.00	
Sub-Contracting	- Geotech Ltd. (ZTEM survey)			109,193.45	
				------------	109,401.70
4. Transportation					
4x4 trucks	1 days @	$45 per day		45.00	
	855 km @	50 ¢ per km		427.50	
fuel				126.95	
				------------	599.45

					$116,406.15
5. Corporate Mamangement Fee	@ 10%				11,640.62

			Total Exploration Expenditures:		**$128,046.77**

11.0 STATEMENT OF QUALIFICATIONS

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Vernon, B.C. V1T 6M8

I, Thomas H. Carpenter, B.Sc., P.Geo., do hereby certify that:

1. I am a consulting geologist in mineral exploration with Discovery Consultants, 201, 2928 29th Street, Vernon, BC, V1T 5A6.

2. I am a 1971 graduate of the Memorial University of Newfoundland with a Bachelor of Science degree in geology.

3. I have been practicing my profession since graduation. I have over 39 years experience in mineral exploration on six continents for a variety of base and precious metals and diamonds. My working experience includes grassroots & reconnaissance exploration, project evaluation, geological mapping, planning and execution of drilling programs, and project reporting and project management.

4. I am a Professional Geoscientist with the Association of Professional Engineers and Geoscientists of British Columbia (membership #20277).

5. This report is based upon knowledge of the Property gained from the management of, and field work on, exploration programs carried out on the Property in 1988 and 1989, the study of available documentation, and the results of the 2011 ZTEM program.

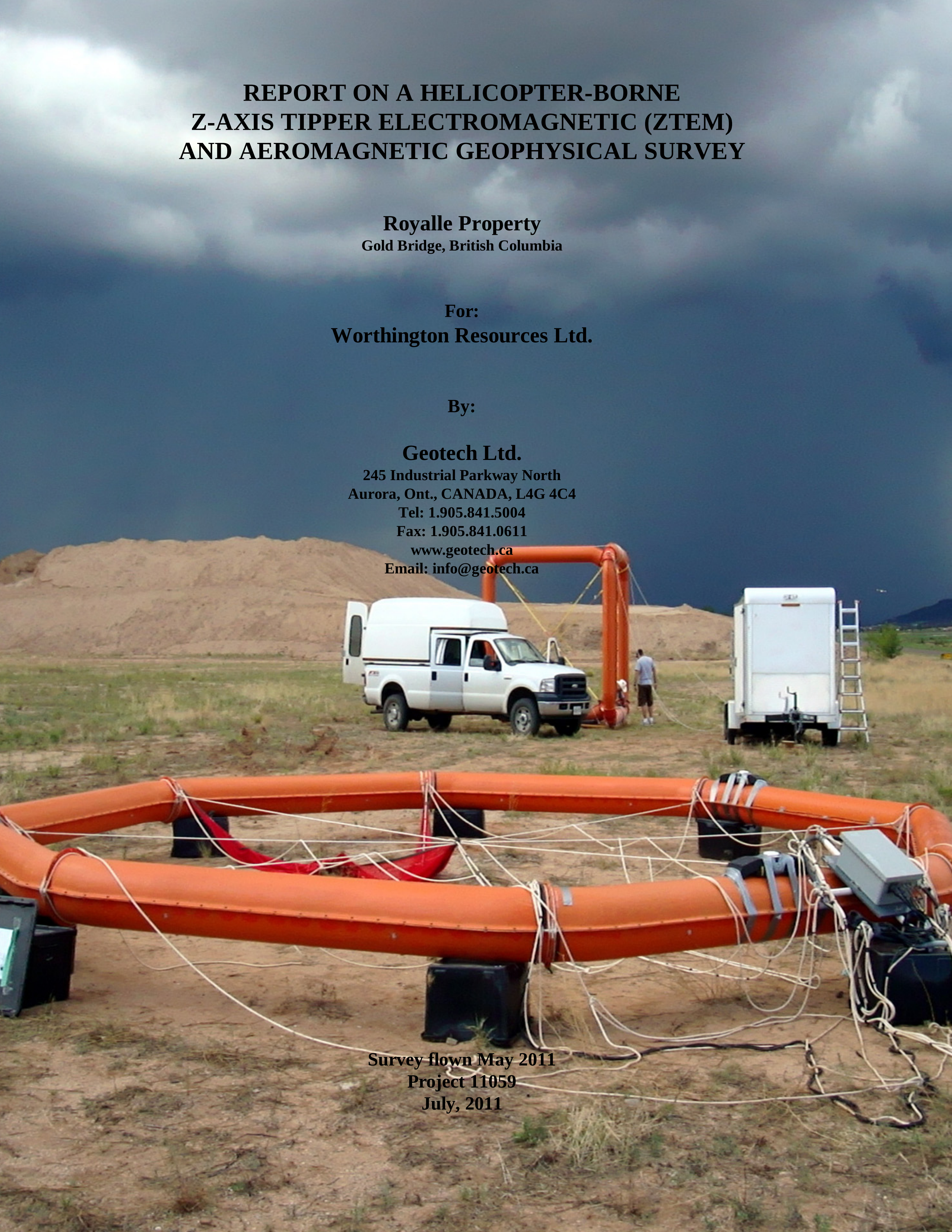
Dated this 15th[h] day of December, 2011 in Vernon, BC.

Original Signed by Author
____
Signature of T. H. Carpenter, P.Geo.

Discovery Consultants

APPENDIX I

Report on A Helicopter-borne Z-Axis Tipper Electromagnetic (ZTEM) and Aeromagnetic Geophysical Survey
Royalle Property
Gold Bridge, British Columbia



REPORT ON A HELICOPTER-BORNE Z-AXIS TIPPER ELECTROMAGNETIC (ZTEM) AND AEROMAGNETIC GEOPHYSICAL SURVEY

Royalle Property
Gold Bridge, British Columbia

For:
Worthington Resources Ltd.

By:

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Aurora, Ont., CANADA, L4G 4C4
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Survey flown May 2011
Project 11059
July, 2011

TABLE OF CONTENTS

EXECUTIVE SUMMARY .... **III**
1. INTRODUCTION **1**
1.1 General Considerations 1
1.2 Survey Location 2
1.3 Topographic Relief and Cultural Features 3
2. DATA ACQUISITION **4**
2.1 Survey Area 4
2.2 Survey Operations 4
2.3 Flight Specifications 5
2.4 Aircraft and Equipment 5
2.4.1 Survey Aircraft 5
2.4.2 Airborne Receiver 5
2.4.3 Base Station Receiver 6
2.4.4 Airborne magnetometer 7
2.4.5 Radar Altimeter 7
2.4.6 GPS Navigation System 7
2.4.7 Digital Acquisition System 8
2.4.8 Mag Base Station 8
3. PERSONNEL **9**
4. DATA PROCESSING AND PRESENTATION **10**
4.1 Flight Path 10
4.2 In-field Processing and Quality Control 10
4.3 GPS Processing 10
4.4 ZTEM Electromagnetic Data 11
4.4.1 Preliminary Processing 11
4.4.2 Geosoft Processing 11
4.4.3 Final Processing 12
4.4.4 ZTEM Profile Sign Convention 12
4.4.5 ZTEM Quadrature Sign Dependence 13
4.4.6 Total Divergence and Phase Rotation Processing 14
4.4.7 2D EM Inversion 15
4.5 Magnetic Data 15
5. DELIVERABLES **16**
5.1 Survey Report 16
5.2 Maps 16
5.3 Digital Data 16
6. CONCLUSIONS AND RECOMMENDATIONS **21**
6.1 Conclusions 21
6.2 Recommendations 21
7. REFERENCES AND SELECTED BIBLIOGRAPHY **22**

LIST OF FIGURES

Figure 1 -Property Location 1
Figure 2 – The Block, with ZTEM and Magnetic Base Station Locations 2
Figure 3 - Google Earth image of the block 3
Figure 4 - ZTEM System Configuration 6
Figure 5 - ZTEM base station receiver coils. 7
Figure 6 - ZTEM Crossover Polarity Conventions for Tzx and Tzy for the block 13
Figure 7 - Illustration of ZTEM In-Phase & Quadrature Tipper transfer function polarity convention (e-iωt) relative to equivalent MT Tipper Quadrature polarity convention (e+iωt) for a graphitic conductor in Athabasca Basin, SK. 14

LIST OF TABLES

Table 1 - Survey Specifications 4
Table 2 - Survey schedule 4
Table 3 - Acquisition and Processing Sampling Rates..8
Table 4 - Geosoft GDB Data Format 17

APPENDICES

A. Survey Location Maps ....
B. Survey Block Coordinates ....
C. Geophysical Maps ....
D. ZTEM Theoretical Considerations ....
E. ZTEM Tests over Unconformity Uranium Deposits...
F. 2D Inversions...

REPORT ON A HELICOPTER-BORNE Z-AXIS, TIPPER ELECTROMAGNETIC (ZTEM) AND AREOMAGNETIC GEOPHYSICAL SURVEY

Royalle Property
Gold Bridge, British Columbia

Executive Summary

During May 22nd to May 30th, 2011 Geotech Ltd. carried out a helicopter-borne geophysical survey for Worthington Resources Ltd. over the Royalle Property situated 25 kilometres southeast of Gold Bridge, British Columbia, Canada.

Principal geophysical sensors included a Z-Axis Tipper electromagnetic (ZTEM) system, and a caesium magnetometer. Ancillary equipment included a GPS navigation system and a radar altimeter. A total of 396 line-kilometres of geophysical data were acquired during the survey.

The survey operations were based out of the town of Gold Bridge, British Columbia. In-field data quality assurance and preliminary processing were carried out on a daily basis during the acquisition phase. Preliminary and final data processing, including generation of final digital data and map products were undertaken from the office of Geotech Ltd. in Aurora, Ontario.

The survey report describes the procedures for data acquisition, processing, final image presentation and the specifications for the digital data set. 2D inversions over selected lines were performed in support of the ZTEM survey results.

1. INTRODUCTION

1.1 General Considerations

These services are the result of the Agreement made between Geotech Ltd. and Worthington Resources Ltd. to perform a helicopter-borne geophysical survey over the Royalle Property located 25 kilometres southeast of Gold Bridge, British Columbia, Canada. (Figure 1).

Gerry Carlson represented Worthington Resources Ltd. during the data acquisition and data processing phases of this project.

The geophysical surveys consisted of helicopter borne AFMAG Z-axis Tipper electromagnetic (ZTEM) system and aero magnetics using a caesium magnetometer. A total of 396 line kilometres of geophysical data were acquired during the survey. The survey area is shown in Figure 2.

In a ZTEM survey, a single vertical-dipole air-core receiver coil is flown over the survey area in a grid pattern, similar to regional airborne EM surveys. Two orthogonal, air-core horizontal axis coils are placed close to the survey site to measure the horizontal EM reference fields. Data from the three coils are used to obtain the Tzx and Tzy Tipper (Vozoff, 1972) components at six frequencies in the 30 to 720 Hz band. The ZTEM is useful in mapping geology using resistivity contrasts and magnetometer data provides additional information on geology using magnetic susceptibility contrasts.

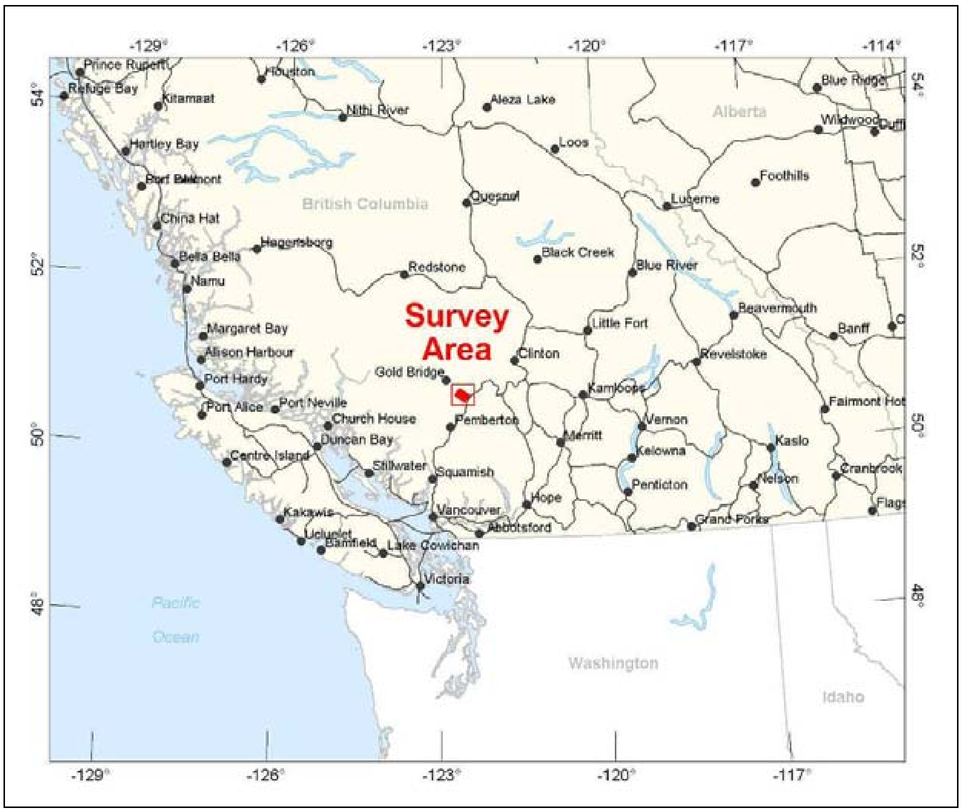

Figure 1 -Property Location

The crew was based out of Gold Bridge, British Columbia, for the acquisition phase of the survey. Survey flying was started on May 22nd and finished on May 30th, 2011.

Data quality control and quality assurance, and preliminary data processing were carried out on a daily basis during the acquisition phase of the project. Final reporting, data presentation and archiving were completed from the Aurora office of Geotech Ltd. in July, 2011.

1.2 Survey Location

The block is located approximately 25 kilometres southeast of Gold Bridge, British Columbia, as shown in Figure 2.

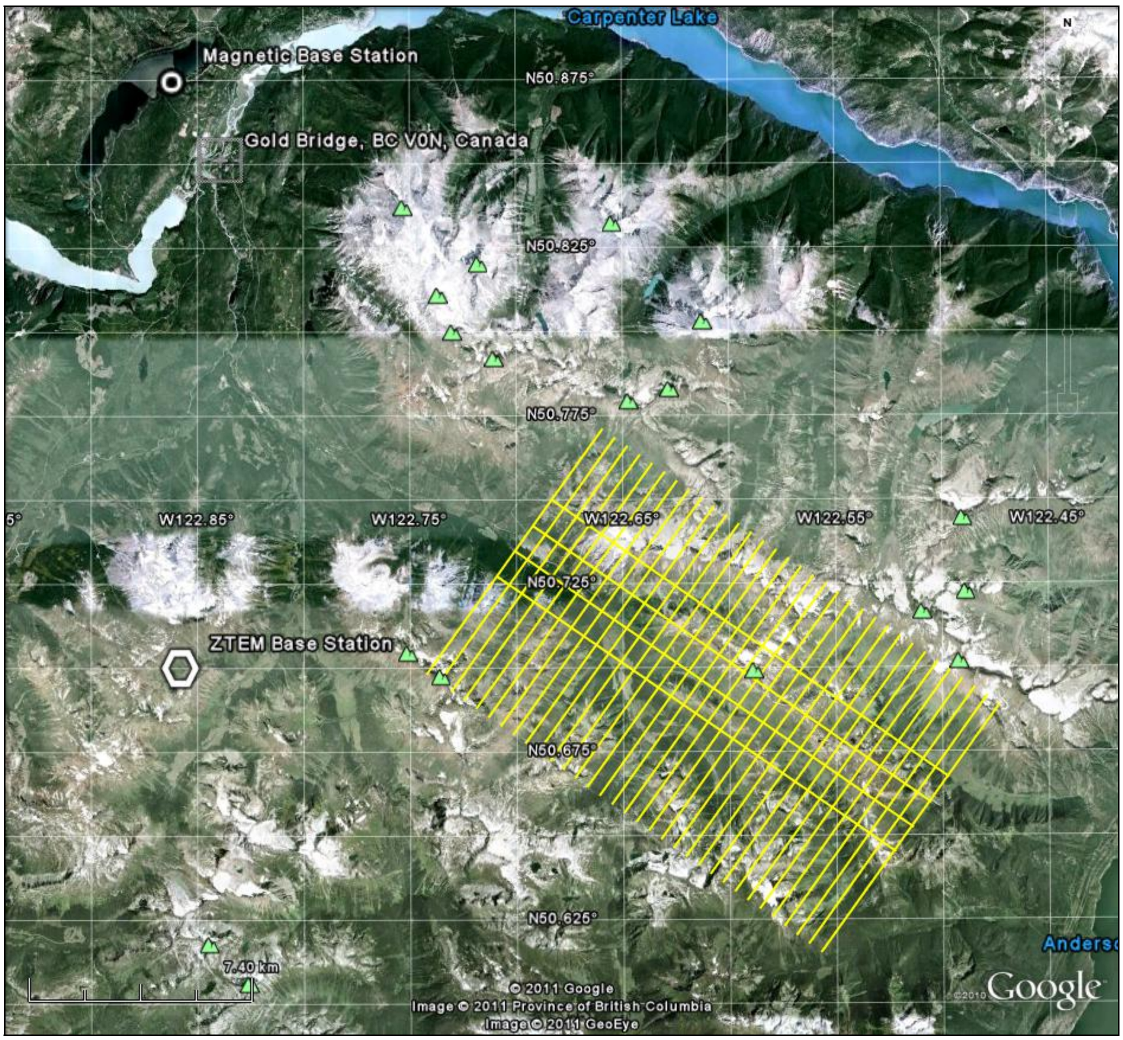

Figure 2 – The Block, with ZTEM and Magnetic Base Station Locations

The survey was flown in a northeast to southwest (N 35° E azimuth) direction, with a flight line spacing of 500 metres, as depicted in Figure 3. Tie lines were flown perpendicular to the survey lines with a spacing of 1000 metres. For more detailed information on the flight spacing and direction see Table 1.

1.3 Topographic Relief and Cultural Features

Topographically, the block exhibits a high relief with elevations ranging from 1148 to 2610 metres above mean sea level over an area of 164 square kilometres (Figure 3). There are many small rivers and streams found throughout the block, as well as a number of trails running through the middle. Special care is recommended in identifying any potential cultural features from other sources that might be recorded in the data.

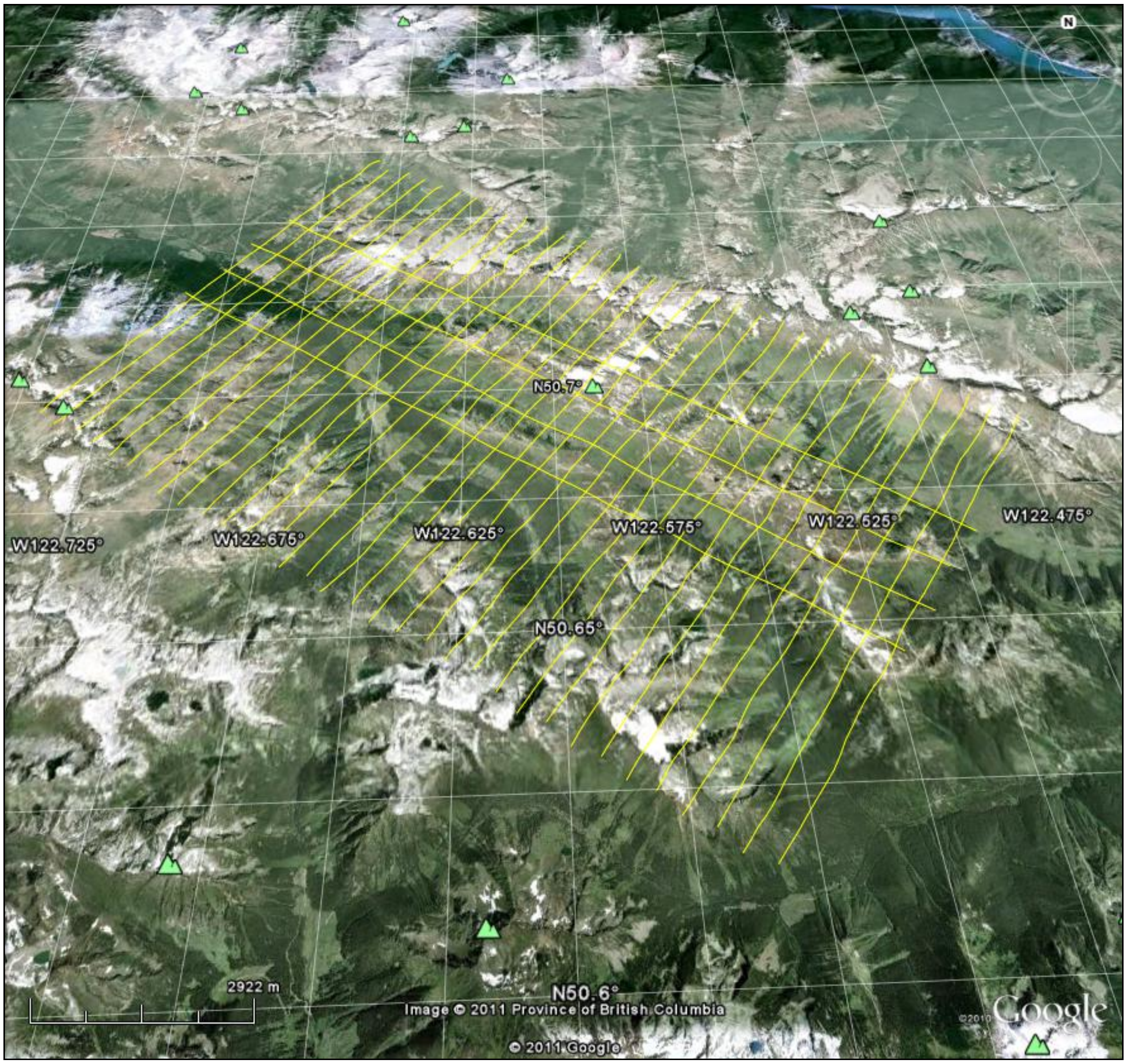

Figure 3 - Google Earth image of the block

2. DATA ACQUISITION

2.1 Survey Area

The survey block (see Location map in Appendix A and Figure 2) and general flight specifications are as follows:

Table 1 - Survey Specifications

Survey block	Traverse Line spacing (m)	Area (Km^2)	Planned Line-km	Actual[1] Line-km	Flight direction	Line numbers
Royalle Property	Traverse: 500	164	396	408.5	N 35° E / N 215° E	L1000 – L1320
	Tie: 1000				N 125° E / N 305° E	T1900 – T1930
TOTAL		**164**	**396**	**408.5**		

Survey block boundaries co-ordinates are provided in Appendix B.

2.2 Survey Operations

Survey operations were based out of Gold Bridge, British Columbia from May 22nd, 2011 until May 30th, 2011. The following table shows the timing of the flying.

Table 2 - Survey schedule

Date	Flight #	Block	Crew location	Comments
22-May-2011			Gold Bridge, BC	System assembly
23-May-2011			Gold Bridge, BC	System assembly & testing
24-May-2011			Gold Bridge, BC	testing
25-May-2011	1,2	Royalle	Gold Bridge, BC	testing completed - Production
26-May-2011			Gold Bridge, BC	No production due to weather
27-May-2011			Gold Bridge, BC	No production due to weather
28-May-2011			Gold Bridge, BC	No production due to weather
29-May-2011	3,4	Royalle	Gold Bridge, BC	Production
30May-2011	5,6	Royalle	Gold Bridge, BC	Production – Job Completed

[1] Actual line-km represents the total line-km contained in the final databases. These line-km normally exceed the Planned line-km's, as indicated in the survey NAV files.

2.3 Flight Specifications

During the survey the helicopter was maintained at a mean height of 297 metres above the ground with a nominal survey speed of 80 km/hour for the survey block. This allowed for a nominal EM sensor terrain clearance of 227 metres and a magnetic sensor clearance of 242 metres.

The on board operator was responsible for monitoring the system integrity. He also maintained a detailed flight log during the survey, tracking the times of the flight as well as any unusual geophysical or topographic feature.

On return of the aircrew to the base camp the survey data was transferred from a compact flash card (PCMCIA) to the data processing computer. The data were then uploaded via ftp to the Geotech office in Aurora for daily quality assurance and quality control by trained personnel.

2.4 Aircraft and Equipment

2.4.1 Survey Aircraft

The survey was flown using a Eurocopter Aerospatiale (Astar) 350 B3 helicopter, registration number C-GABH. The helicopter was operated by Bull Horn Helicopters. Installation of the geophysical and ancillary equipment was carried out by a Geotech Ltd crew.

2.4.2 Airborne Receiver

The airborne ZTEM receiver coil measures the vertical component (Z) of the EM field. The receiver coil is a Geotech Z-Axis Tipper (ZTEM) loop sensor which is isolated from most vibrations by a patented suspension system and is encased in a fibreglass shell. It is towed from the helicopter using an 85 metre long cable as shown in Figure 4. The cable is also used to transmit the measured EM signals back to the data acquisition system.

The coil has a 7.4 metre diameter with an orientation to the Vertical Dipole. The digitizing rate of the receiver is 2000 Hz. Attitudinal positioning of the receiver coil is enabled using 3 GPS antennas mounted on the coil. The output sampling rate is 0.4 seconds (see Section 2.4.7)

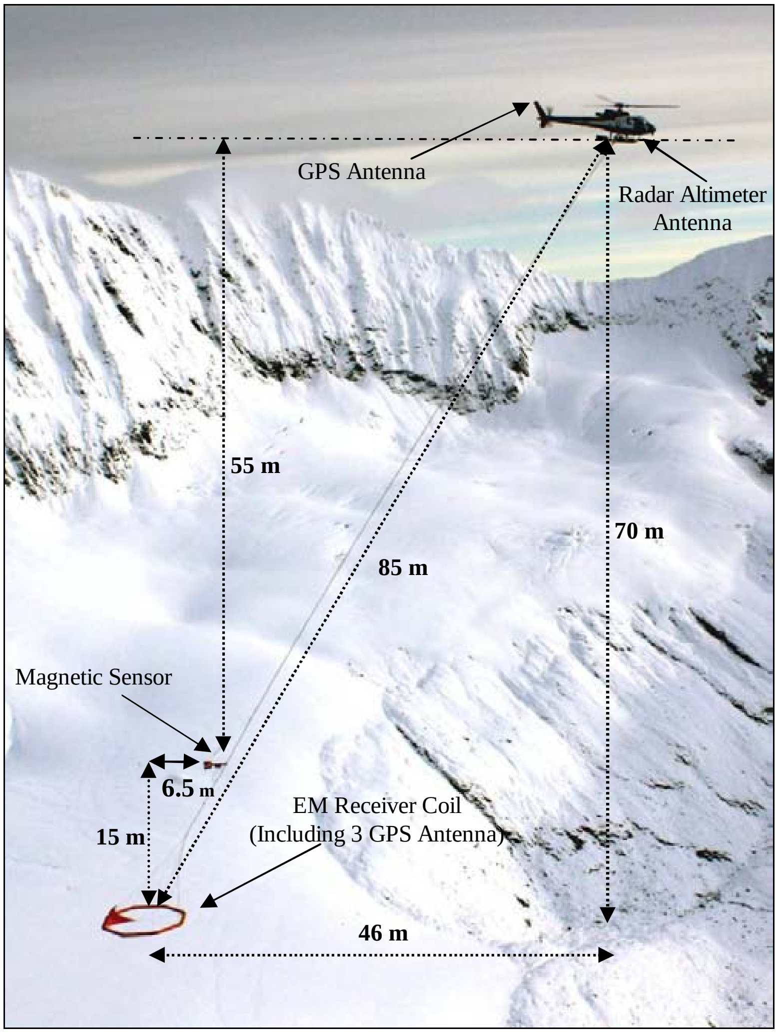

Figure 4 - ZTEM System Configuration

2.4.3 Base Station Receiver

The two Geotech ZTEM base station receiver coils measure the orthogonal, horizontal X and Y components of the EM reference field. They are set up perpendicular to each other and roughly oriented according to the flight line direction. The orientation of both units is not critical as the horizontal field can be further decomposed into the two orientations of the survey flight. The orientation of the base stations were measured using a compass.

The base station coils each have a diameter of 3.5 meters, with the coil orientations to the horizontal dipole, as shown in Figure 5.

The base station receiver coils were installed in valley near a river (50.700027° N, 122.857704° W). The azimuth of the reference coil was N56°E (named as A) and for the orthogonal component it was N146°E (named as B). Angles A and B are taken into account together with the survey lines azimuth to calculate the in-line (Tzx) and cross-line (Tzy) field utilizing a proprietary software.

Figure 5 - ZTEM base station receiver coils.

2.4.4 Airborne magnetometer

The magnetic sensor utilized for the survey was a Geometrics split-beam optically pumped caesium vapour magnetic field sensor, mounted in a separate bird, and towed on a cable at a mean distance of 57 metres below the helicopter (Figure 4). The sensitivity of the magnetic sensor is 0.02 nanoTesla (nT) at a sampling interval of 0.1 seconds. The magnetometer will perform continuously in areas of high magnetic gradient with the ambient range of the sensor approximately 20k-100k nT. The Aerodynamic magnetometer noise is specified to be less than 0.5 nT. The magnetometer sends the measured magnetic field strength as nanoTesla to the data acquisition system via the RS-232 port.

2.4.5 Radar Altimeter

A Terra TRA 3000/TRI 40 radar altimeter was used to record terrain clearance. The antenna was mounted beneath the bubble of the helicopter cockpit.

2.4.6 GPS Navigation System

The navigation system used was a Geotech PC104 based navigation system utilizing a NovAtel CDGPS (Canada-Wide Differential Global Positioning System Correction Service) enabled Propak V3-RT20 GPS receiver. Geotech's Navigate software, using a full screen display with controls in front of the pilot, allows him to direct the flight.

5 NovAtel GPS antennas are utilized during the survey; one is mounted on the helicopter tail (Figure 4), one installed with the Receiver Base Station (Figure 5) and three are mounted on the airborne receiver (Figure 4). As many as 14 GPS and two CDGPS satellites may be monitored at any one time. The horizontal positional accuracy or circular error probability (CEP) is 1.8 m, with CDGPS active, it is 0.6 m. The co-ordinates of the block were set-up prior to the survey and the information was fed into the airborne navigation system.

2.4.7 Digital Acquisition System

The power supply and the data acquisition system are mounted on an equipment rack which is installed into the helicopter. Signal and power wires are run through the helicopter to connect on to the tow cable outside. The tow cable supports the ZTEM and magnetometer birds during flight via a safety shear pin connected to the helicopter hook. The major power and data cables have a quick disconnect safety feature as well. The installation was undertaken by the Geotech Ltd. crew and was certified before surveying.

A Geotech data acquisition system recorded the digital survey data on an internal compact flash card. Data is displayed on an LCD screen as traces to allow the operator to monitor the integrity of the system. The data type and sampling interval as provided in Table 3.

Table 3 - Acquisition and Processing Sampling Rates

DATA TYPE	ACQUISITION SAMPLING	PROCESSING SAMPLING
ZTEM Receiver	0.0005 sec	0.4 sec
Magnetometer	0.1 sec	0.4 sec
GPS Position	0.2 sec	0.4 sec
Radar Altimeter	0.2 sec	0.4 sec
ZTEM Base station	0.0005 sec	– –

2.4.8 Mag Base Station

A combined magnetometer/GPS base station was utilized on this project. A Geometrics Caesium split-beam vapour magnetometer was used as a magnetic sensor with a sensitivity of 0.001 nT. The base station was recording the magnetic field together with the GPS time at 1 Hz on a base station computer.

The base station magnetometer sensors (50° 52.5018’ N, 122° 51.6707’ W) were installed at by the lake near the crew’s accommodations, away from electric transmission lines and moving ferrous objects such as motor vehicles. The base station data were backed-up to the data processing computer at the end of each survey day.

3. PERSONNEL

The following Geotech Ltd. personnel were involved in the project.

<u>Field:</u>

Project Manager:	Darren Tuck (Office)
Data QC:	Emilio Schein (Office)
Crew chief:	Joseph Florjancic
Operator:	Jonathan Yantho

The survey pilot and the mechanical engineer were employed directly by the helicopter operator – Bull Horn Helicopters.

Pilot:	Brook Pennington
Mechanical Engineer:	n/a

<u>Office:</u>

Preliminary Data Processing:	Nick Venter
Final Data Processing:	Nick Venter
Final Data QC:	Ali Latrous & Francis Tong
2D Inversions:	Shengkai Zhao
Reporting/Mapping:	Kyle Orlowski

Data acquisition phase was carried out under the supervision of Andrei Bagrianski, P. Geo, Chief Operating Officer. Processing and 2D Inversions phases were carried out under the supervision of Jean Legault, P. Geo, P. Eng, Chief Geophysicist (Interpretation). The overall contract management and customer relations were by Paolo Berardelli.

4. DATA PROCESSING AND PRESENTATION

Data compilation and processing were carried out by the application of Geosoft OASIS Montaj and programs proprietary to Geotech Ltd.

4.1 Flight Path

The flight path, recorded by the acquisition program as WGS 84 latitude/longitude, was converted into the NAD83, UTM Zone 10 North coordinate system in Oasis Montaj.

The flight path was drawn using linear interpolation between x, y positions from the navigation system. Positions are updated every second and expressed as UTM easting's (x) and UTM northing's (y).

4.2 In-field Processing and Quality Control

In-Field data processing and quality control are done on a flight by flight basis by a qualified data processor (see Section 3.0). Processing steps and check up procedures are designed to assure the best possible final quality of ZTEM survey data. A general overview of those steps is presented in the following paragraphs.

The In-Field quality control can be separated into several phases:

a. GPS Processing Phase: GPS Data are first examined and evaluated during the GrafMov processing.

b. Raw data, ZTEM viewer phase:

   Data can be viewed, examined for consistency, individual channel spectra examined and overall noise estimated in the viewer provided by the ZTEM proprietary software, on the raw flight data and raw base station data separately, on the merged data, and finally on the data that have undergone ZTEM processing.

c. Field Geosoft phase:

   Magnetic data, Radar altimeter data, GPS positioning data are re-examined and processed in this phase. Prior to splitting the lines EM data are examined flight by flight and the effectiveness of applying the attitude correction evaluated. After splitting the lines, a set of grids are generate for each parameter and their consistency evaluated. Data profiles are also re-evaluated on a line to line basis. A power line monitor channel is available in order to identify power line noise.

4.3 GPS Processing

Three GPS sensor (mounted on the airborne receiving loop) measurements were differentially corrected using the Waypoint GrafMov™ software in order to yield attitude corrections to recorded EM data.

4.4 ZTEM Electromagnetic Data

The ZTEM data were processed using proprietary software. Processing steps consist of the following preliminary and final processing steps:

4.4.1 Preliminary Processing

a. Airborne EM, Mag, radar altimeter and GPS data are first merged with EM base station data into one file.
b. Merged data are viewed and examined for consistency in an incorporated viewer
c. In the next, processing phase, the following entities are taken into account:
   - the Base station coils orientation with respect to the Magnetic North,
   - the Local declination of the magnetic field,
   - Suggested direction of the X coordinate (North or line direction),
   - Sensitivity coefficient that compensates for the difference in geometry between the base station and airborne coils.
   - Rejection filters for the 60 Hz and helicopter generated frequencies.
d. Six frequencies (30, 45, 90, 180, 360, and 720 Hz) are extracted from the airborne EM time-series coil response using windows of 0.4 seconds and the base station coils using windows of 1.0 seconds.
e. The real (In-Phase) and imaginary (Quadrature) parts of the tipper transfer functions are derived from the In-line (X or Tzx) and Cross-line (Y or Tzy) components.
f. Such processed EM data are then merged with the GPS data, magnetic base station data and exported into a Geosoft xyz file.

4.4.2 Geosoft Processing

Next stage of the preliminary data processing is done in a Geosoft ™ environment, using the following steps:

a. Import the output xyz file from the AFMAG processing, as well as the base Mag data into one database.
b. Split lines according to the recorded line channel,
c. GPS processing, flight path recovery (correcting, filtering, calculating Bird GPS coordinates, line splitting)
d. Radar altimeter processing, yielding the altitude values in metres.
e. Magnetic spike removal, filtering (applied to both airborne and base station data). Calculation of a base station corrected mag.
f. Apply preliminary attitude corrections to EM data (In phase and Quadrature), filter and make preliminary grids and profiles of all channels.

4.4.3 Final Processing

Final data processing and quality control were undertaken by Geotech Ltd headquarters in Aurora, Ontario by qualified senior data processing personnel.

A quality control step consisted of re-examining all data in order to validate the preliminary data processing and to allow for final adjustments to the data.

Attitude corrections were re-evaluated, and re-applied, on component by component, flight by flight, and frequency by frequency bases. Any remaining line to line system noise was removed by applying a mild additional levelling correction.

Due to the mountainous terrain, the flight elevations occasionally caused the aircraft's on-board radar to fall out of range. The absence of radar data resulted in no-values being recorded for the digital elevation model (DEM) and EM bird altitude (alt_b) channels. In such cases the "DEM" and "alt_b" data have been replaced by dummy (*) values.

To make up for their absence, for 2D inversion and other interpretation purposes, the digital elevation model was approximated using the available satellite radar topographic model "SRTM 90m World Elevation" from the Geosoft DAP server and the alt_b was then recalculated using the receiver bird on-board GPS . The resulting "SRTM_dem" and "SRTM_alt_b" channels have been added to the final database.

4.4.4 ZTEM Profile Sign Convention

Tzx and Tzy tipper components do not exhibit maxima or minima above conductors, resistors or at contacts; in fact they produce cross-over type anomalies (Ward, 1959; Vozoff, 1972; Labson, 1985). The crossover polarity sign convention for ZTEM is according to the right hand Cartesian rule (Z positive –up) that is commonly used for multi-component transient electromagnetic methods.

For the southwest to northeast lines of the survey the sign convention for the in-phase Tzx in-line component crossover is positive-negative pointing southwest to northeast for tabular conductors perpendicular to the profile (Figure 6). The corresponding Tzy component in-phase cross-over polarity is positive-negative pointing northwest to southeast (90 degrees counter clockwise to Tzx) according to the right hand Cartesian rule.

For the northwest to southeast lines of the survey the sign convention for the in-phase Tzx in-line component crossover is positive-negative pointing northwest to southeast for tabular conductors perpendicular to the profile (Figure 6). The corresponding Tzy component in-phase cross-over polarity is positive-negative pointing southwest to northeast (90 degrees counter clockwise to Tzx) according to the right hand Cartesian rule.

Conversely, tabular resistive bodies produce In-Phase cross-over's that are opposite in sign to conductors. A brief discussion of ZTEM and AFMAG, along with selected forward model responses is presented in Appendix D.

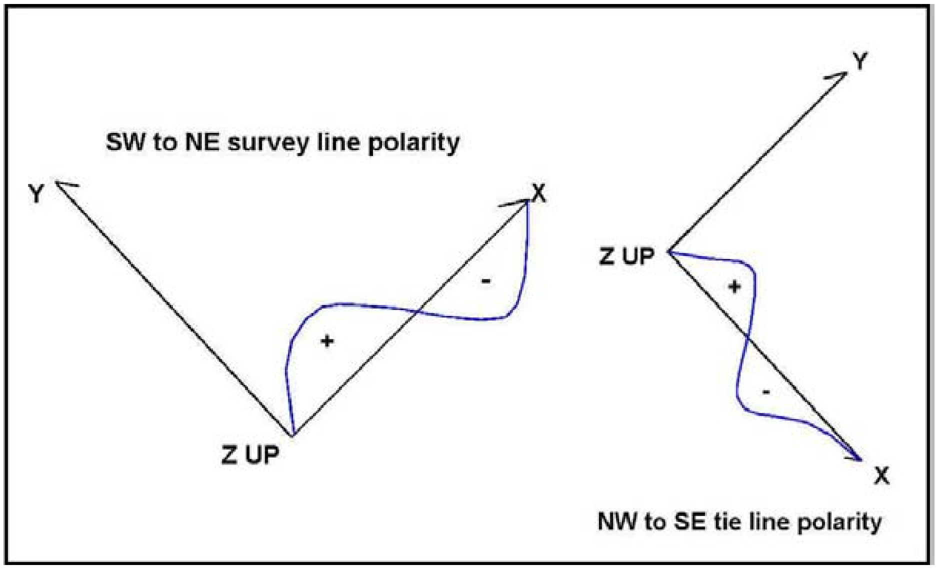

Figure 6 - ZTEM Crossover Polarity Conventions for Tzx and Tzy for the block

4.4.5 ZTEM Quadrature Sign Dependence

One important note regarding the sign of the ZTEM Quadrature, relative to the In-Phase component, particularly with regards to computer modeling and inversion.

The sign of the magnetotelluric Quadrature relative to the In-Phase tipper transfer function component pertains to the Fourier transformation of the time series to give frequency domain spectra. There are two widely used conventions for time dependence in the transformations, **exp(+iωt)** and **exp(-iωt).** That which is implemented largely is a matter of personal preference and precedent. The importance of the In-Phase and Quadrature sign convention is not critical, provided that it is known and documented.

In ZTEM, the data processing code used for the Fourier transformation the time-series data to frequency domain spectra adopts a **exp(-iωt)** time dependence (J. Dodds, Geo Equipment Manufacturing, pers. comm., Nov-2009). Whereas in the forward modeling and inversion program Zvert2d, the sign of the Quadrature relative to the In-Phase transfer function assumes an **exp(+iωt)** dependence[2].

As a result, for users interested in computer modeling and inversion of ZTEM data, the sign of the Quadrature will need to be reversed, relative to the In-Phase component, in order to provide a proper result (Figure 7). Indeed this reverse Quadrature polarity convention is assumed in all forward modeling and inversion of ZTEM data, as described in Figures 5-7 in Appendix D.

2 Phillip E. Wannamaker (2009): Two-dimensional Inversion of ZTEM data: Synthetic Model Study and Test Profile Images, Internal Geotech technical report by Emblem Exploration Services Inc., January 22, 2009, 32 pp.

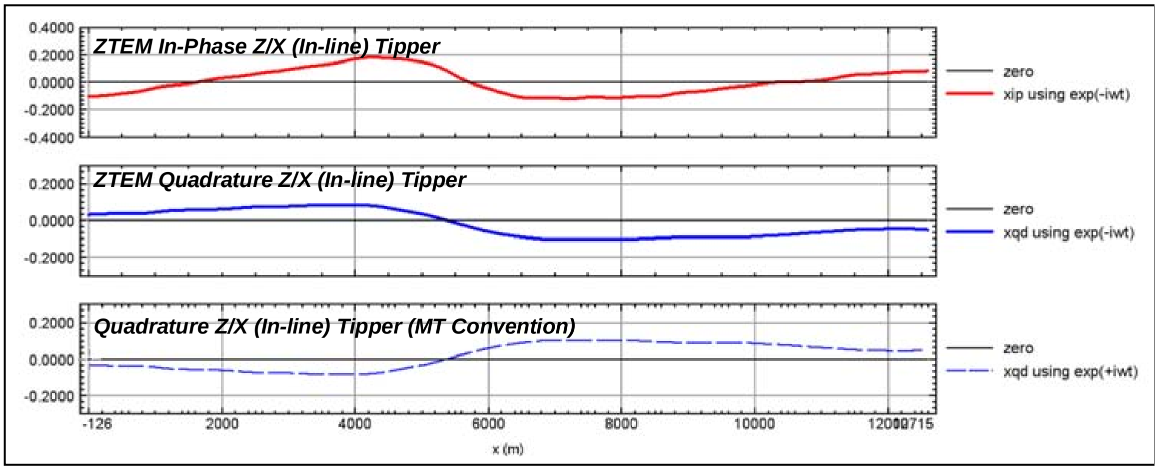

Figure 7 - Illustration of ZTEM In-Phase & Quadrature Tipper transfer function polarity convention (e-iωt) relative to equivalent MT Tipper Quadrature polarity convention (e+iωt) for a graphitic conductor in Athabasca Basin, SK.

4.4.6 Total Divergence and Phase Rotation Processing

In a final processing step DT (Total Divergence) and PR (Phase Rotation) processing are applied to the multi-frequency In-phase and Quadrature ZTEM data. This is due to the crossover nature of the Tipper Responses; these additional processing steps are applied to convert them into local maxima for easier interpretation.

To present the data from both tipper components into one image, the Total Divergence parameter, termed the DT is calculated from the horizontal derivatives of the Tzx and Tzy tippers (Lo and Zang, 2008). It is analogous to the “Peaker” parameter in VLF (Pedersen, 1998).

Total Divergence DT: ***DT = DIV (*****Tzx, Tzy*****)***
= d(**Tzx** ***)/dx+d(*****Tzy*****)/dy***

This DT parameter was introduced by Petr Kuzmin (Milicevic, 2007, p. 13) and is derived for each of the In Phase and Quadrature components at individual frequencies. These in turn allow for minima over conductors and maxima over resistive zones. DT grids for each of the extracted frequencies were generated accordingly, using a reverse colour scheme with warm colours over conductors and cool colours over resistors.

The DT gives a clearer image of conductor’s location and shape but, as a derivative, it does not preserve some of the long wavelength information and is also sensitive to noise.

As an alternative, a 90 degree Phase Rotation (PR) technique is also applied to the grids of each individual component (Tzx and Tzy). It transforms bipolar (cross over) anomalies into single pole anomalies with a maximum over conductors, while preserving long wavelength information (Lo et al., 2009). The two orthogonal grids are then usually added to obtain a Total Phase Rotated (TPR) grid for the In-Phase and Quadrature.

Total Phase-Rotation TPR*:** ***= PR (*Tzx*) + PR (*Tzy*)

A presentation of the ZTEM test survey results over unconformity uranium deposits that illustrates DT and TPR examples, as documented by Lo et al. (2009) is provided in Appendix E.

4.4.7 2D EM Inversion

2d inversions of the ZTEM results were performed over selected lines using the Geotech Av2dtopo software developed by Phil Wannamaker, U. of Utah, for Geotech Ltd. The inversion algorithm is based on the 2D inversion code with Jacobians of de Lugao and Wannamaker (1996), the 2D forward code of Wannamaker et al (1987), and the Gauss-Newton parameter step equations of Tarantola (1987). Av2dtopo has been developed/modified for use with our ZTEM platform by taking into account the ground topography and the air-layer between the radar bird and the ground surface.

The 2D code only considers the In-Line (Tzx) data and assumes that the strike lengths of bodies are infinite and orthogonal to the profile. The code is designed to account for the ZTEM vertical coil receiver and fixed base station reference measurements. The inversion uses a model-mesh consisting of 440 cells laterally and 112 cells vertically. Typically the ZTEM data are de-sampled to 180-200 pts, in order to allow the inversion to run in 20 minutes or less. Typically, between 1-2% errors are added to the In-line in-phase (XIP) and Quadrature (XQD) data obtained at 30,45,90,180,360 & 720Hz. Errors are adjusted until numerical convergence (<1.0 rms) is attained in 5 iterations or less. All inversions are based on an apriori homogeneous starting half-space model, usually between 100 – 1000ohm metres, as determined by the interpreter.

4.5 Magnetic Data

The processing of the total magnetic field intensity (TMI) data involved the correction for diurnal variations by using the digitally recorded ground base station magnetic values. The base station magnetometer data was edited and merged into the Geosoft GDB database on a daily basis. The aeromagnetic data was corrected for diurnal variations by subtracting the observed magnetic base station deviations.

Tie line levelling was carried out by adjusting intersection points along traverse lines. A micro-levelling procedure was applied to remove persistent low-amplitude components of flight-line noise remaining in the data.

The corrected magnetic data was interpolated between survey lines using a random point gridding method to yield x-y grid values for a standard grid cell size of 100 metres. The Minimum Curvature algorithm was used to interpolate values onto a rectangular regular spaced grid.

5. DELIVERABLES

5.1 Survey Report

The survey report describes the data acquisition, processing, and final presentation of the survey results. The survey report is provided in two paper copies and digitally in PDF format.

5.2 Maps

Final maps were produced at scale of 1:50,000. The coordinate/projection system used was NAD83, UTM Zone 10 North. All maps show the flight path trace and topographic data; latitude and longitude are also noted on maps.

The preliminary and final results of the survey are presented as profile plans for the EM data that were generated for individual real (In-Phase) and imaginary parts (Quadrature) of the Tzx and Tzy components. Colour contour maps of the corresponding DT (Total Divergence) or TPR (Total Phase Rotated) grids for three of the six frequencies, (30, 45, 90, 180, 360, and 720Hz), as well as for corresponding Phase Rotated Grids for individual components.

3D views have been constructed by plotting the either DT or TPR grids at their respective penetration depths using a 1000 ohm-m half space, using the Bostick skin depth rule (Bostick, 1977) see Appendix D.

Final maps were chosen, in consultation with the client, to represent all collected data, are listed in Section 5.3.

Sample maps of the related 3D view, Magnetic and Total Divergence are included in this report and presented in Appendix C.

5.3 Digital Data

- Two copies of the data and maps on a DVD were prepared to accompany the report. Each DVD contains a digital file of the line data in GDB Geosoft Montaj.

- DVD structure.

  There are two (2) main directories;

  Data contains databases and grids, as described below.

  Report contains a copy of the report and appendices in PDF format.

  Databases in Geosoft GDB format, containing the channels listed in Table 4.

Table 4 - Geosoft GDB Data Format

Column	Description
X:	UTM Easting NAD83 Zone 10N, (Centre of the ZTEM loop) (metres)
Y:	UTM Northing NAD83 Zone 10N, (Centre of the ZTEM loop) (metres)
Longitude:	Longitude – NAD83 (Centre of the ZTEM loop) (Decimal degree)
Latitude	Latitude – NAD83 (Centre of the ZTEM loop) (Decimal degree)
Z:	Elevation - (Centre of the ZTEM loop) (metres)
Radar:	Helicopter terrain clearance from radar altimeter (metres - AGL)
Alt_B:	Calculated ZTEM Bird terrain clearance (metres)
DEM	Digital Elevation Model (above mean sea level, meters)
SRTM_dem	Digital Elevation Model calculated from SRTM (above mean sea level, meters)
SRTM_alt_b	Calculated ZTEM Bird terrain clearance from SRTM (metres)
Gtime	UTC Time (seconds of the day)
basemag	Magnetic base station data, nT
Mag1	Measured total magnetic field, nT5
Mag2	Diurnally corrected total magnetic field, nT
Mag3:	Levelled total magnetic field, nT
xIp_030Hz:	Tzx In-Phase 30 Hz final corrected
xIp_045Hz:	Tzx In-Phase 45 Hz final corrected
xIp_090Hz:	Tzx In-Phase 90 Hz final corrected
xIp_180Hz:	Tzx In-Phase 180 Hz final corrected
xIp_360Hz:	Tzx In-Phase 360 Hz final corrected
xIp_720Hz:	Tzx In-Phase 720 Hz final corrected
xQd_030Hz:	Tzx Quadrature 30 Hz final corrected
xQd_045Hz:	Tzx Quadrature 45 Hz final corrected
xQd_090Hz:	Tzx Quadrature 90 Hz final corrected
xQd_180Hz:	Tzx Quadrature 180 Hz final corrected
xQd_360Hz:	Tzx Quadrature 360 Hz final corrected
xQd_720Hz:	Tzx Quadrature 720 Hz final corrected
yIp_030Hz:	Tzy In-Phase 30 Hz final corrected
yIp_045Hz:	Tzy In-Phase 45 Hz final corrected
yIp_090Hz:	Tzy In-Phase 90 Hz final corrected
yIp_180Hz:	Tzy In-Phase 180 Hz final corrected
yIp_360Hz:	Tzy In-Phase 360 Hz final corrected
yIp_720Hz:	Tzy In-Phase 720 Hz final corrected
yQd_030Hz:	Tzy Quadrature 30 Hz final corrected
yQd_045Hz:	Tzy Quadrature 45 Hz final corrected
yQd_090Hz:	Tzy Quadrature 90 Hz final corrected
yQd_180Hz:	Tzy Quadrature 180 Hz final corrected
yQd_360Hz:	Tzy Quadrature 360 Hz final corrected
yQd_720Hz:	Tzy Quadrature 720 Hz final corrected
PLM:	Power Line Monitor (60Hz)

- Grids in Geosoft GRD format, as follows:

TMI:	Total Magnetic Intensity
DEM:	Digital Elevation Model
PLM:	Power Line Monitor
SRTM_DEM:	Digital Elevation Model from SRTM
RTP:	Reduced to Pole of Total Magnetic Intensity
XIP_30Hz_PR:	Tzx In-Phase Component Phase Rotated grid at 30 Hz
XIP_45Hz_PR:	Tzx In-Phase Component Phase Rotated grid at 45 Hz
XIP_90Hz_PR:	Tzx In-Phase Component Phase Rotated grid at 90 Hz
XIP_180Hz_PR:	Tzx In-Phase Component Phase Rotated grid at 180 Hz
XIP_360Hz_PR:	Tzx In-Phase Component Phase Rotated grid at 360 Hz
XIP_720Hz_PR:	Tzx In-Phase Component Phase Rotated grid at 720 Hz
XQd_30Hz_PR:	Tzx Quadrature component Phase Rotated grid at 30 Hz
XQd_45Hz_PR:	Tzx Quadrature component Phase Rotated grid at 45 Hz
XQd_90Hz_PR:	Tzx Quadrature component Phase Rotated grid at 90 Hz
XQd_180Hz_PR:	Tzx Quadrature component Phase Rotated grid at 180 Hz
XQd_360Hz_PR:	Tzx Quadrature component Phase Rotated grid at 360 Hz
XQd_720Hz_PR:	Tzx Quadrature component Phase Rotated grid at 720 Hz
YIP_30Hz_PR:	Tzy In-Phase Component Phase Rotated grid at 30 Hz
YIP_45Hz_PR:	Tzy In-Phase Component Phase Rotated grid at 45 Hz
YIP_90Hz_PR:	Tzy In-Phase Component Phase Rotated grid at 90 Hz
YIP_180Hz_PR:	Tzy In-Phase Component Phase Rotated grid at 180 Hz
YIP_360Hz_PR:	Tzy In-Phase Component Phase Rotated grid at 360 Hz
YIP_720Hz_PR:	Tzy In-Phase Component Phase Rotated grid at 720 Hz
YQd_30Hz_PR:	Tzy Quadrature component Phase Rotated grid at 30 Hz
YQd_45Hz_PR:	Tzy Quadrature component Phase Rotated grid at 45 Hz
YQd_90Hz_PR:	Tzy Quadrature component Phase Rotated grid at 90 Hz
YQd_180Hz_PR:	Tzy Quadrature component Phase Rotated grid at 180 Hz
YQd_360Hz_PR:	Tzy Quadrature component Phase Rotated grid at 360 Hz
YQd_720Hz_PR:	Tzy Quadrature component Phase Rotated grid at 720 Hz
XIP_30Hz:	Tzx In-Phase Component grid at 30 Hz
XIP_45Hz:	Tzx In-Phase Component grid at 45 Hz
XIP_90Hz:	Tzx In-Phase Component grid at 90 Hz
XIP_180Hz:	Tzx In-Phase Component grid at 180 Hz
XIP_360Hz:	Tzx In-Phase Component grid at 360 Hz
XIP_720Hz:	Tzx In-Phase Component grid at 720 Hz
XQd_30Hz:	Tzx Quadrature component grid at 30 Hz
XQd_45Hz:	Tzx Quadrature component grid at 45 Hz
XQd_90Hz:	Tzx Quadrature component grid at 90 Hz
XQd_180Hz:	Tzx Quadrature component grid at 180 Hz
XQd_360Hz:	Tzx Quadrature component grid at 360 Hz
XQd_720Hz:	Tzx Quadrature component grid at 720 Hz
YIP_30Hz:	Tzy In-Phase Component grid at 30 Hz
YIP_45Hz:	Tzy In-Phase Component grid at 45 Hz

YIP_90Hz: Tzy In-Phase Component grid at 90 Hz
YIP_180Hz: Tzy In-Phase Component grid at 180 Hz
YIP_360Hz: Tzy In-Phase Component grid at 360 Hz
YIP_720Hz: Tzy In-Phase Component grid at 720 Hz
YQd_30Hz: Tzy Quadrature component grid at 30 Hz
YQd_45Hz: Tzy Quadrature component grid at 45 Hz
YQd_90Hz: Tzy Quadrature component grid at 90 Hz
YQd_180Hz: Tzy Quadrature component grid at 180 Hz
YQd_360Hz: Tzy Quadrature component grid at 360 Hz
YQd_720Hz: Tzy Quadrature component grid at 720 Hz
IP_30Hz_DT: Total Divergence grid from In-phase components at 30 Hz
IP_45Hz_DT: Total Divergence grid from In-phase components at 45 Hz
IP_90Hz_DT: Total Divergence grid from In-phase components at 90 Hz
IP_180Hz_DT: Total Divergence grid from In-phase components at 180 Hz
IP_360Hz_DT: Total Divergence grid from In-phase components at 360 Hz
IP_720Hz_DT: Total Divergence grid from In-phase components at 720 Hz
QD_30Hz_DT: Total Divergence grid from Quadrature components at 30 Hz
QD_45Hz_DT: Total Divergence grid from Quadrature components at 45 Hz
QD_90Hz_DT: Total Divergence grid from Quadrature components at 90 Hz
QD_180Hz_DT: Total Divergence grid from Quadrature components at 180 Hz
QD_360Hz_DT: Total Divergence grid from Quadrature components at 360 Hz
QD_720Hz_DT: Total Divergence grid from Quadrature components at 720 Hz
IP_30Hz_TPR: Total Phase Rotated grid from In-phase components at 30 Hz
IP_45Hz_TPR: Total Phase Rotated grid from In-phase components at 45 Hz
IP_90Hz_TPR: Total Phase Rotated grid from In-phase components at 90 Hz
IP_180Hz_TPR: Total Phase Rotated grid from In-phase components at 180 Hz
IP_360Hz_TPR: Total Phase Rotated grid from In-phase components at 360 Hz
IP_720Hz_TPR: Total Phase Rotated grid from In-phase components at 720 Hz
QD_30Hz_TPR: Total Phase Rotated grid from Quadrature components at 30 Hz
QD_45Hz_TPR: Total Phase Rotated grid from Quadrature components at 45 Hz
QD_90Hz_TPR: Total Phase Rotated grid from Quadrature components at 90 Hz
QD_180Hz_TPR: Total Phase Rotated grid from Quadrature components at 180 Hz
QD_360Hz_TPR: Total Phase Rotated grid from Quadrature components at 360 Hz
QD_720Hz_TPR: Total Phase Rotated grid from Quadrature components at 720 Hz

A Geosoft .GRD file has a .GI metadata file associated with it, containing grid projection information. A grid cell size of 100 metres was used.

- Maps at 1:50,000 scale in Geosoft MAP format, as follows:

11059_50K_3D_IP_DT: 3D view of In-Phase Total Divergence versus Skin Depth (30-720Hz)
11059_50K_TMI: Total Magnetic Intensity (TMI)
11059_50K_DEM: Digital Elevation Model (DEM)
11059_50K_30Hz_IP_DT: 30Hz In-Phase Total Divergence Grid

11059_50K_90Hz_IP_DT: 90Hz In-Phase Total Divergence Grid
11059_50K_360Hz_IP_DT: 360Hz In-Phase Total Divergence Grid
11059_50K_ 30Hz_XIP_PR: 30Hz Phase Rotated In-Phase Tzx Grid
11059_50K_ 90Hz_XIP_PR: 90Hz Phase Rotated In-Phase Tzx Grid
11059_50K_ 360Hz_XIP_PR: 360Hz Phase Rotated In-Phase Tzx Grid
11059_50K_XIP_profiles_90Hz_XIP_PR: Tzx (In-line) In-Phase Profiles over 90Hz Phase Rotated In-Phase Grid
11059_50K_XQD_profiles_90Hz_XQD_PR: Tzx (In-line) Quadrature Profiles over a 90Hz Phase Rotated Quadrature Grid.
11059_50K_YIP_profiles_90Hz_YIP_PR: Tzy(Cross-line) In-Phase Profiles over 90Hz Phase Rotated In-Phase Grid
11059_50K_YQD_profiles_90_YQD_PR: Tzy (Cross-line) Quadrature Profiles over a 90Hz Phase Rotated Quadrature Grid.

- 2D Resistivity Inversion maps for selected survey lines.

- Maps are also presented in PDF format.

- 1:50,000 topographic vectors were taken from the NRCAN Geogratis database at; http://geogratis.gc.ca/geogratis/en/index.html.

- A Google Earth file *"11059_Flightpath.kmz"* is included, showing the flight path of each block. Free versions of Google Earth software from: http://earth.google.com/download-earth.html.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

A helicopter-borne ZTEM and aeromagnetic geophysical survey has been completed over the Royalle Property located near Gold Bridge, British Columbia.

The total area coverage is 164 km^2. Total survey line coverage is 396 line kilometres. The principal sensors included a Z-Axis Tipper electromagnetic (ZTEM) system and a caesium magnetometer. Results have been presented as stacked profiles and contour colour images at a scale of 1:50,000.

There is no summary interpretation included in this report, however 2D inversions over selected lines have been provided in Appendix F.

6.2 Recommendations

Based on the geophysical results obtained, a number of interesting conductive structures were identified across the property. The magnetic results also contain worthwhile information in support of exploration targets of interest. We recommend a more detailed interpretation of the available geophysical data, including additional 2D or 3D inversion in conjunction with the geology, prior to ground follow up and drill testing.

Respectfully submitted[6],

Shengkai Zhao **Geotech Ltd.**	Jean Legault, P. Geo, P. Eng **Geotech Ltd.**
Ali Latrous **Geotech Ltd.**	Francis Tong **Geotech Ltd.**

July 2011

[6]Final data processing of the EM and magnetic data were carried out by Nick Venter. 2D inversions were carried out by Shengkai Zhao from the office of Geotech Ltd. in Aurora, Ontario, under the supervision of Jean Legault, P. Geo, P. Eng, Chief Geophysicist (Interpretation)

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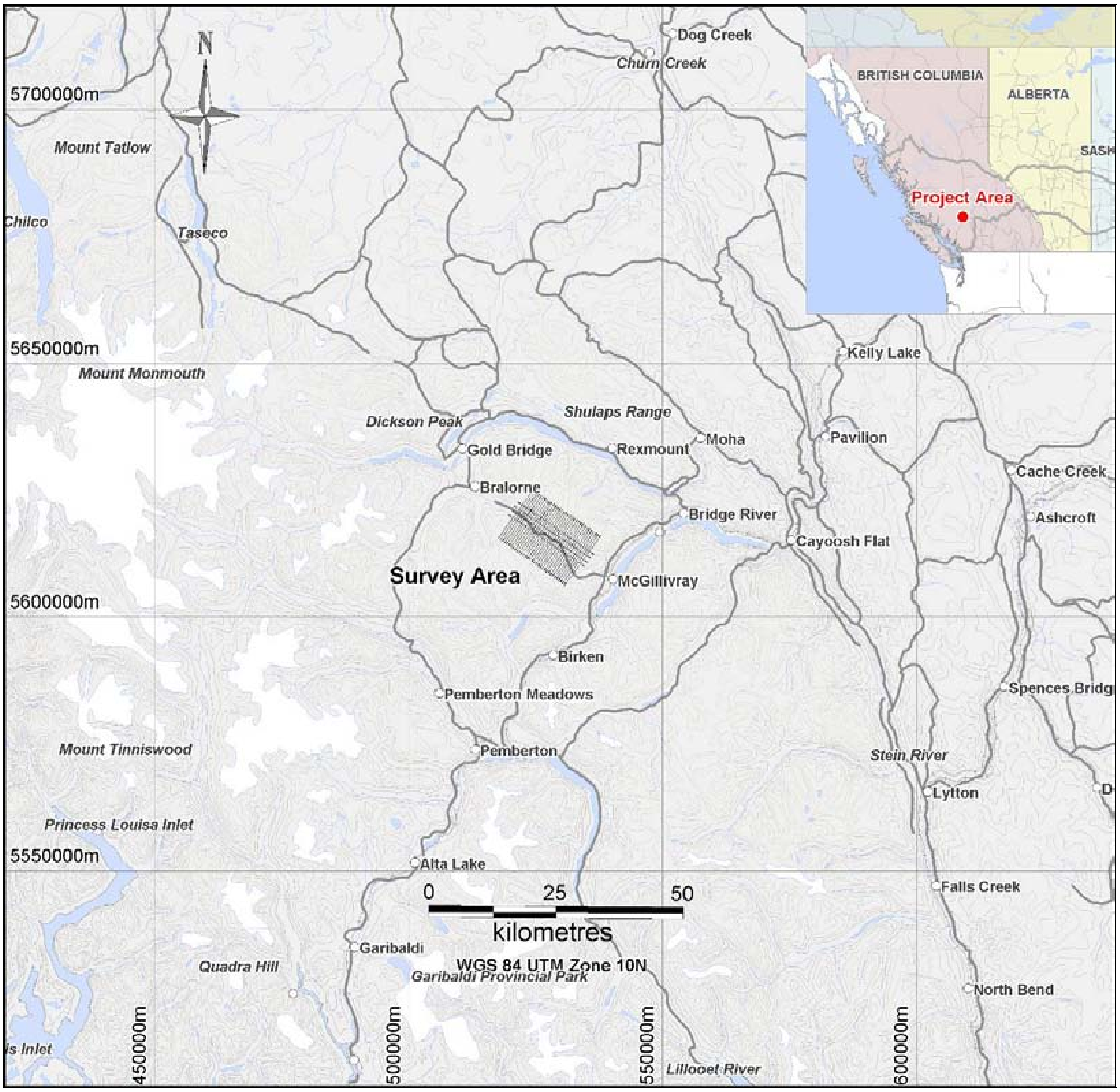
APPENDIX A

SURVEY BLOCK LOCATION MAP



Survey Overview Location Map

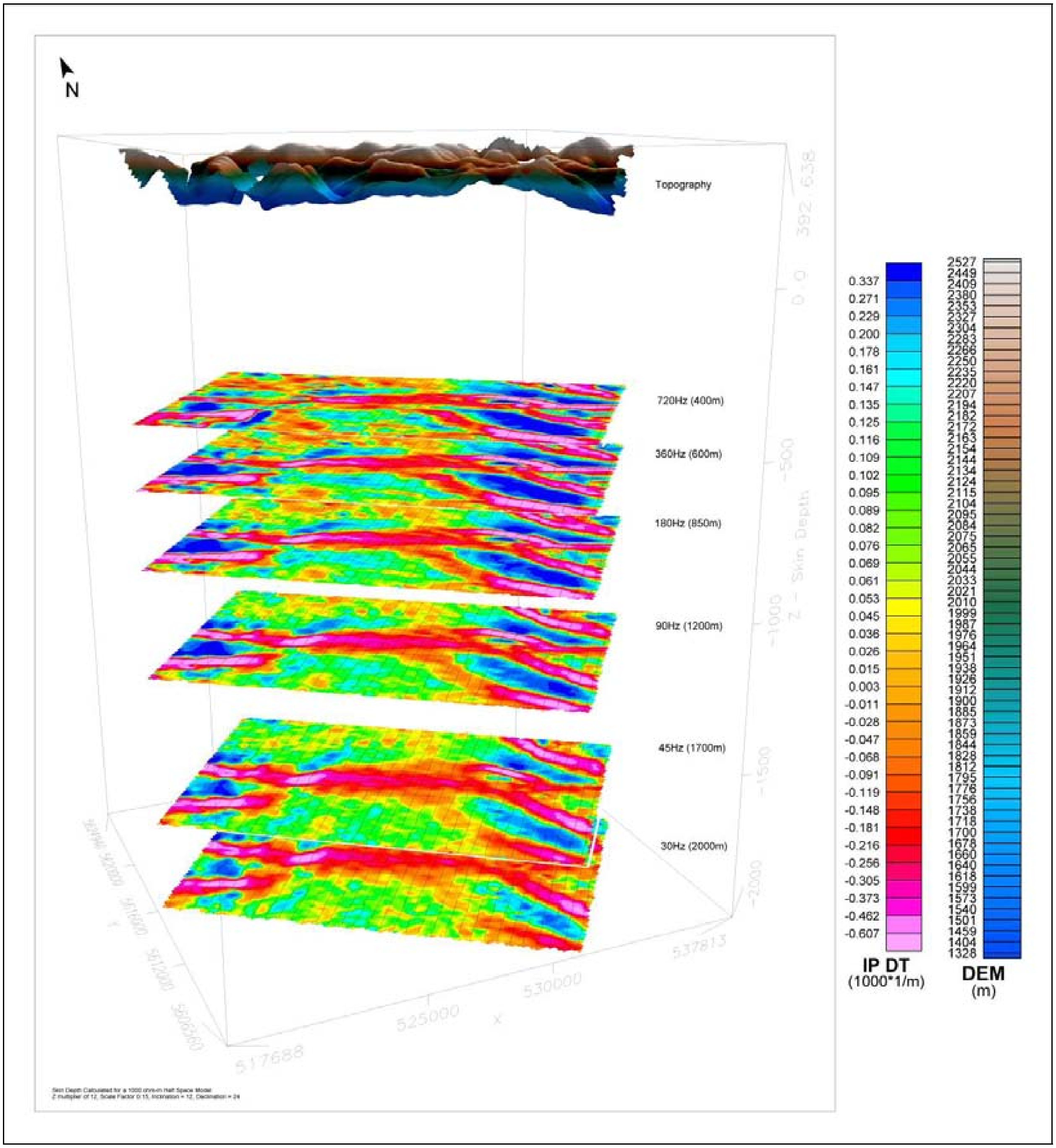
APPENDIX B

SURVEY BLOCK COORDINATES

(NAD83 UTM Zone 10N)

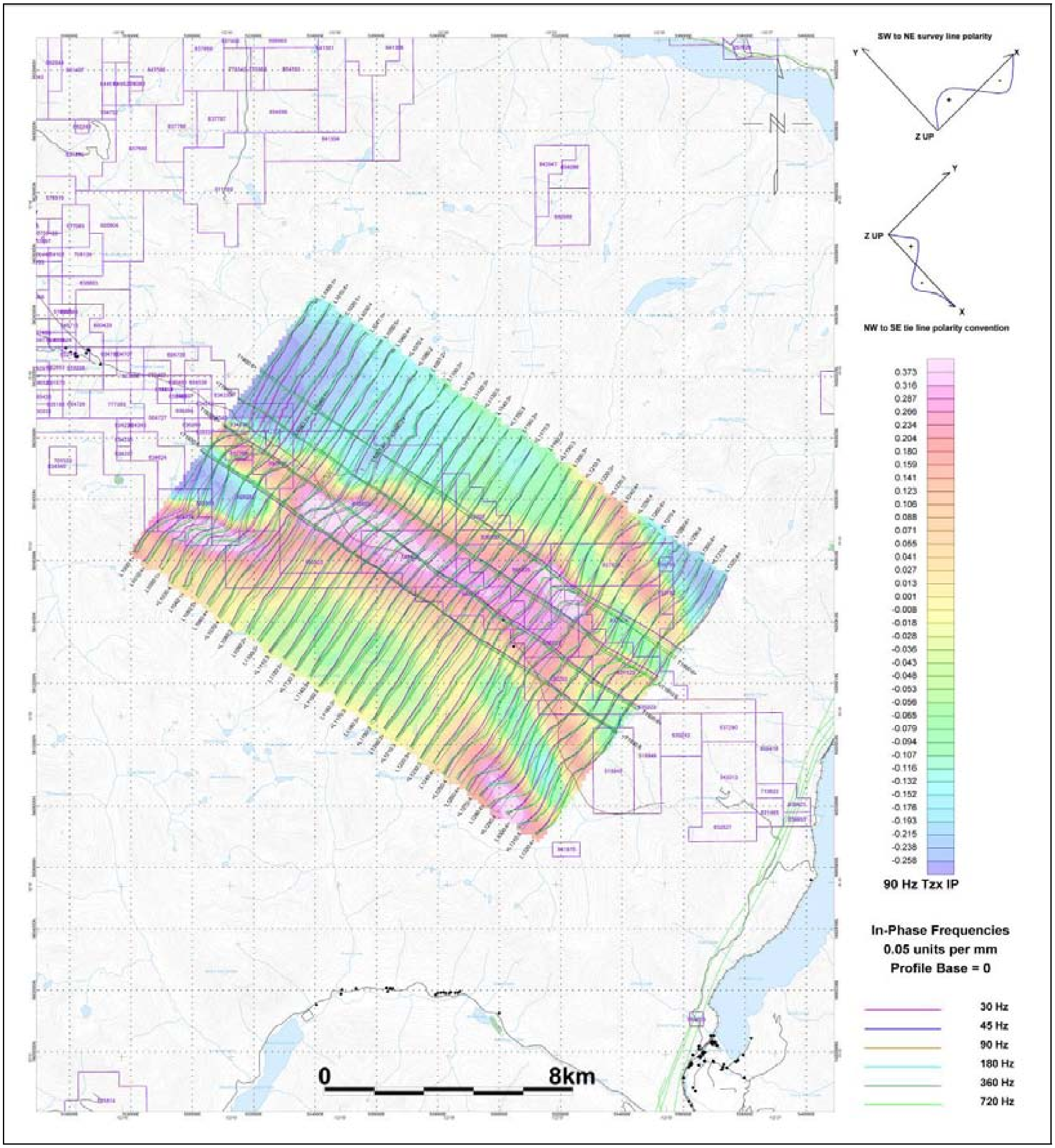
Royalle Property	
X	**Y**
524000	5624410
518189	5616326
531363	5607082
537243	5615342

APPENDIX C
GEOPHYSICAL MAPS[1]

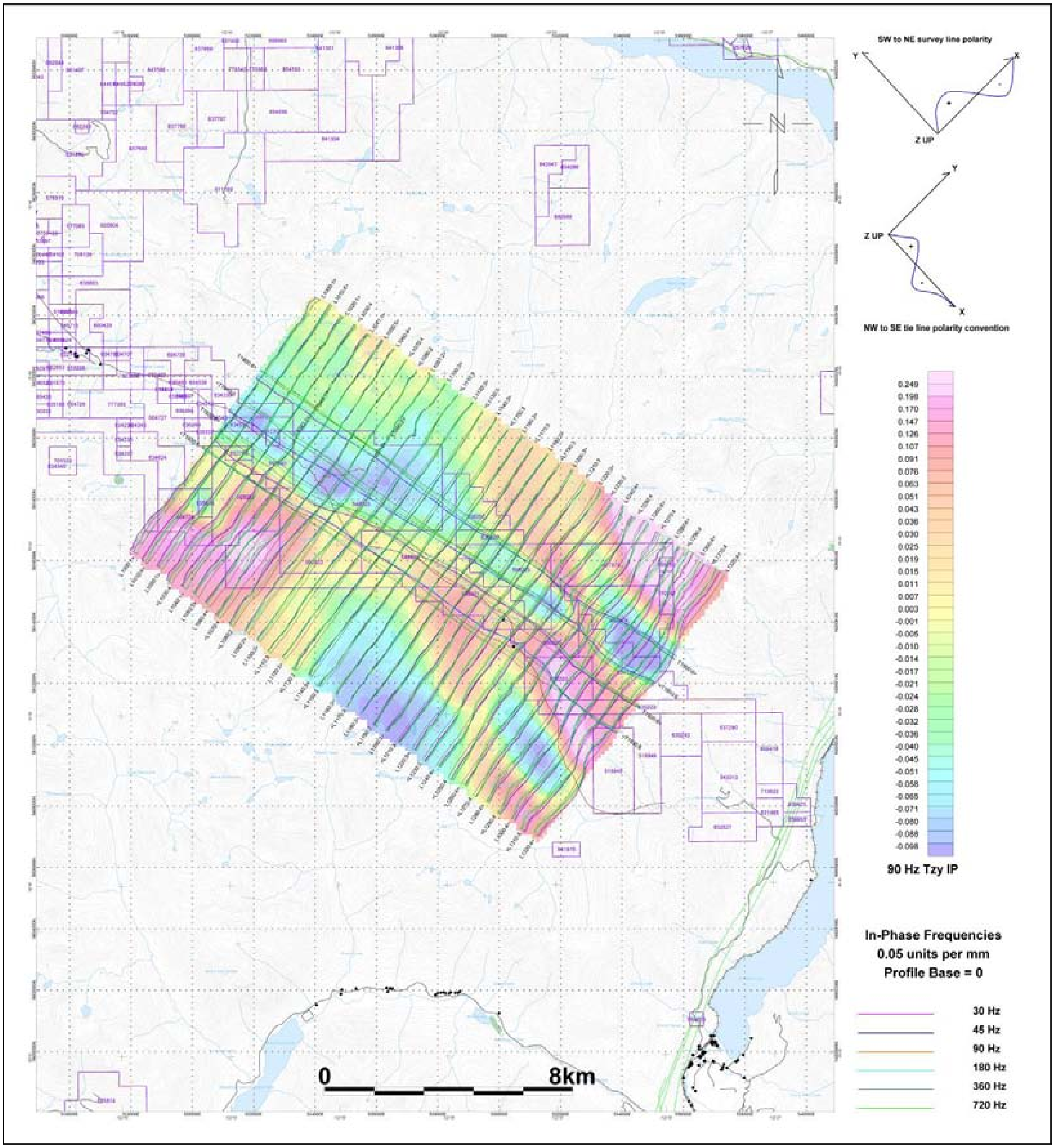


3D View of In-Phase, Total Divergence (DT) grids versus Skin Depth (30 Hz - 720 Hz)

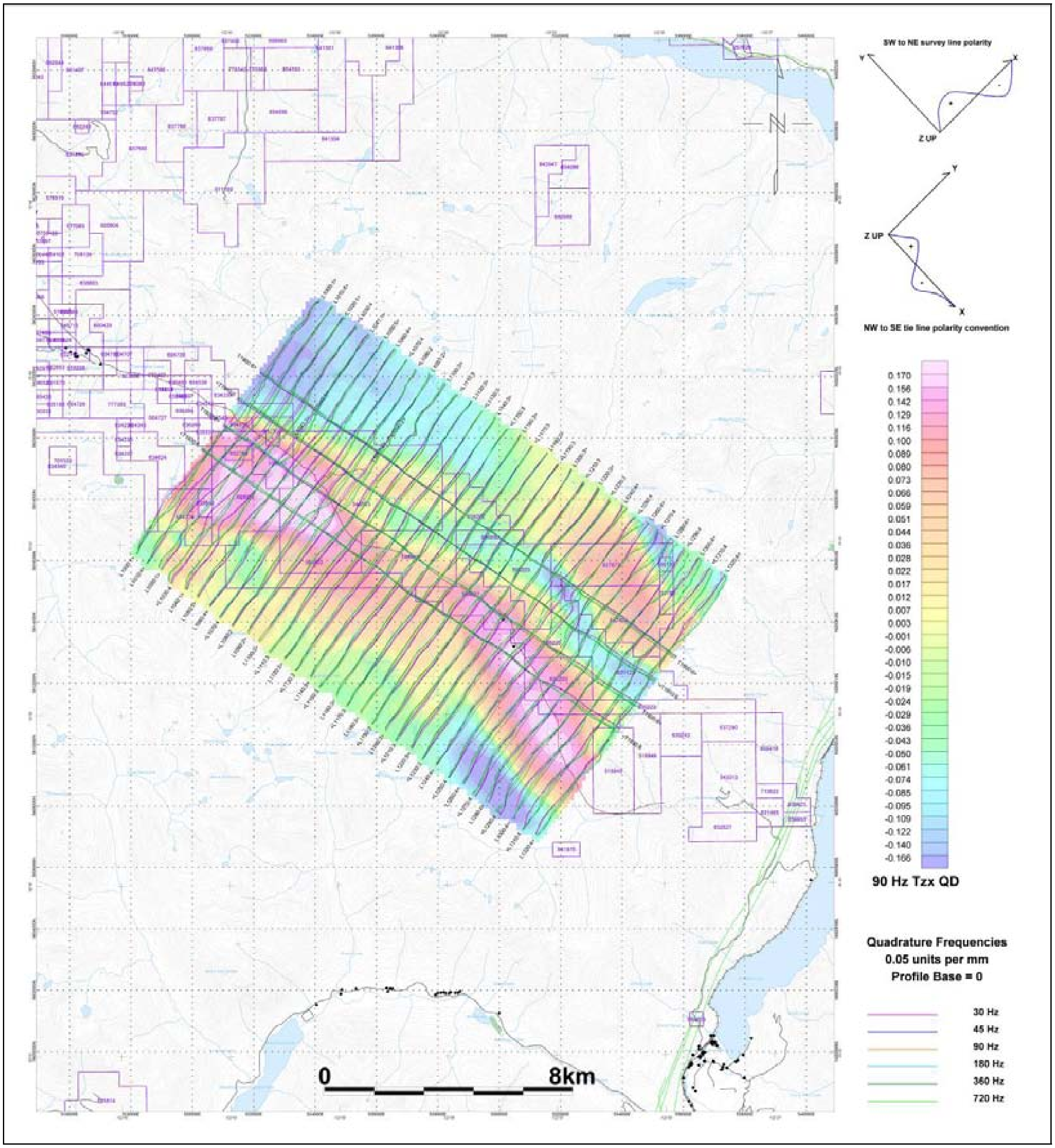
[1] Full size geophysical maps are also available in PDF format on the final DVD



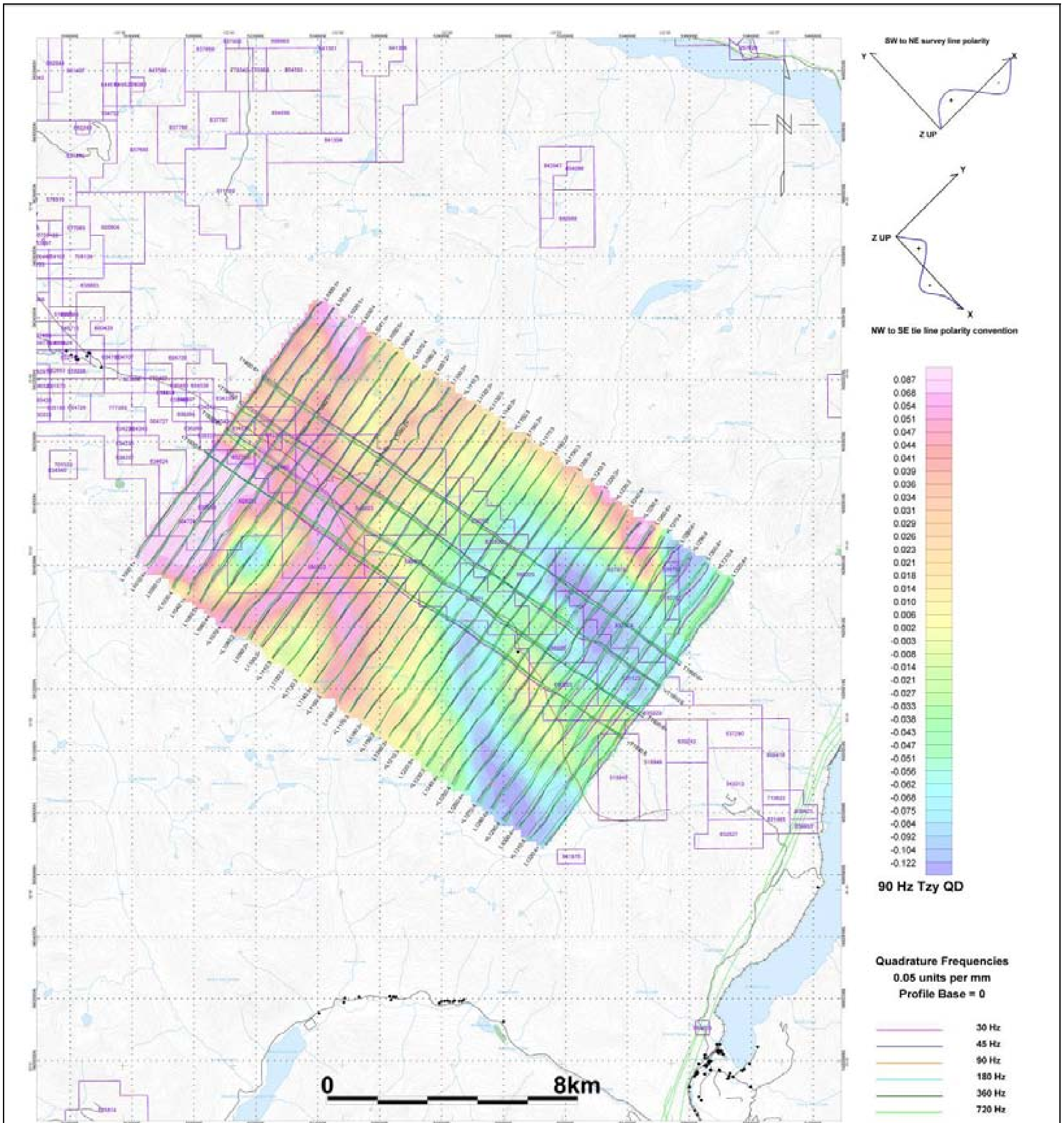
Tzx (In-line) In-Phase Profiles over 90Hz Rotated Tzx In-Phase Grid



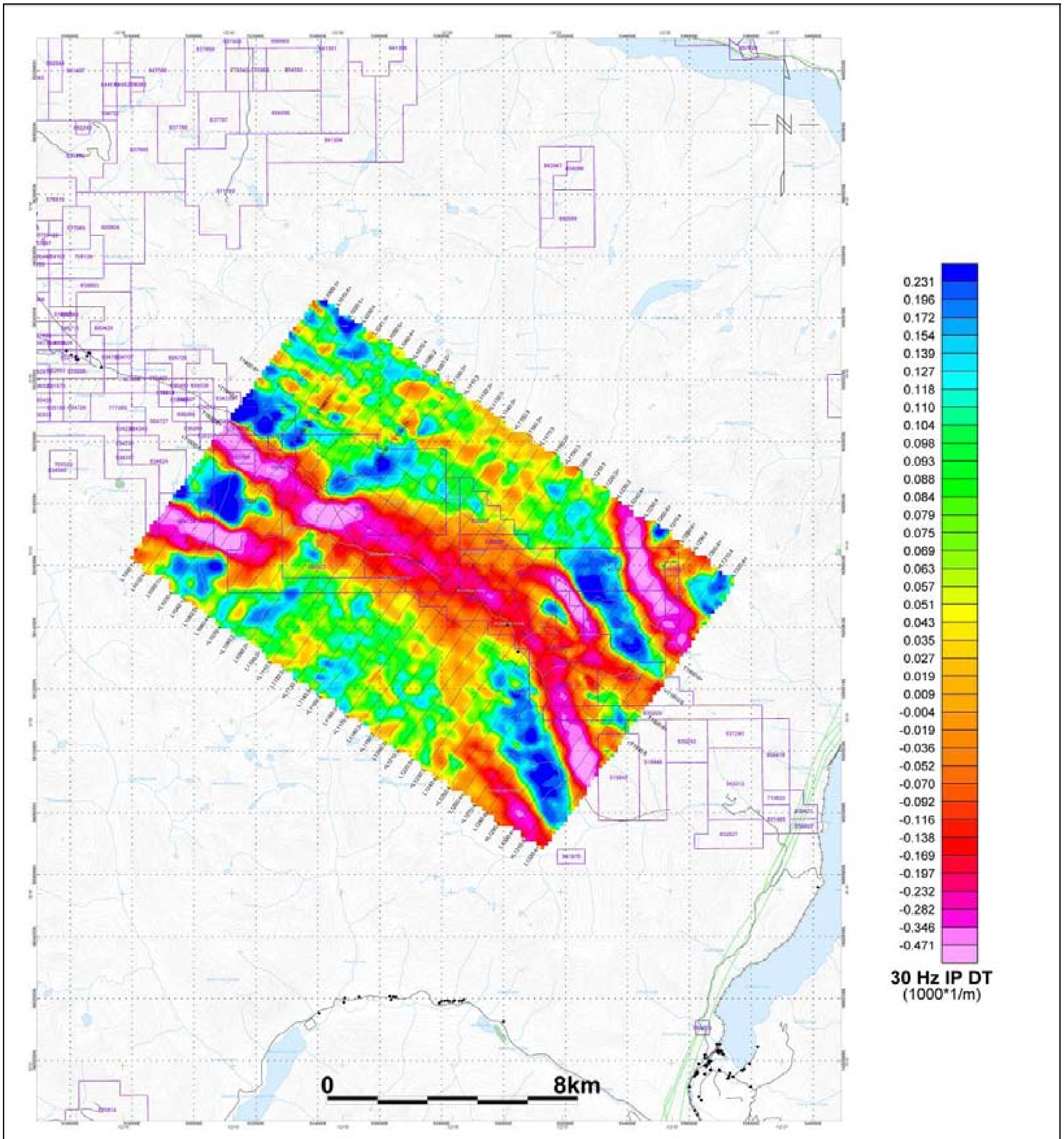
Tzy (Cross-line) In-Phase Profiles over 90Hz Rotated Tzy In-Phase Grid



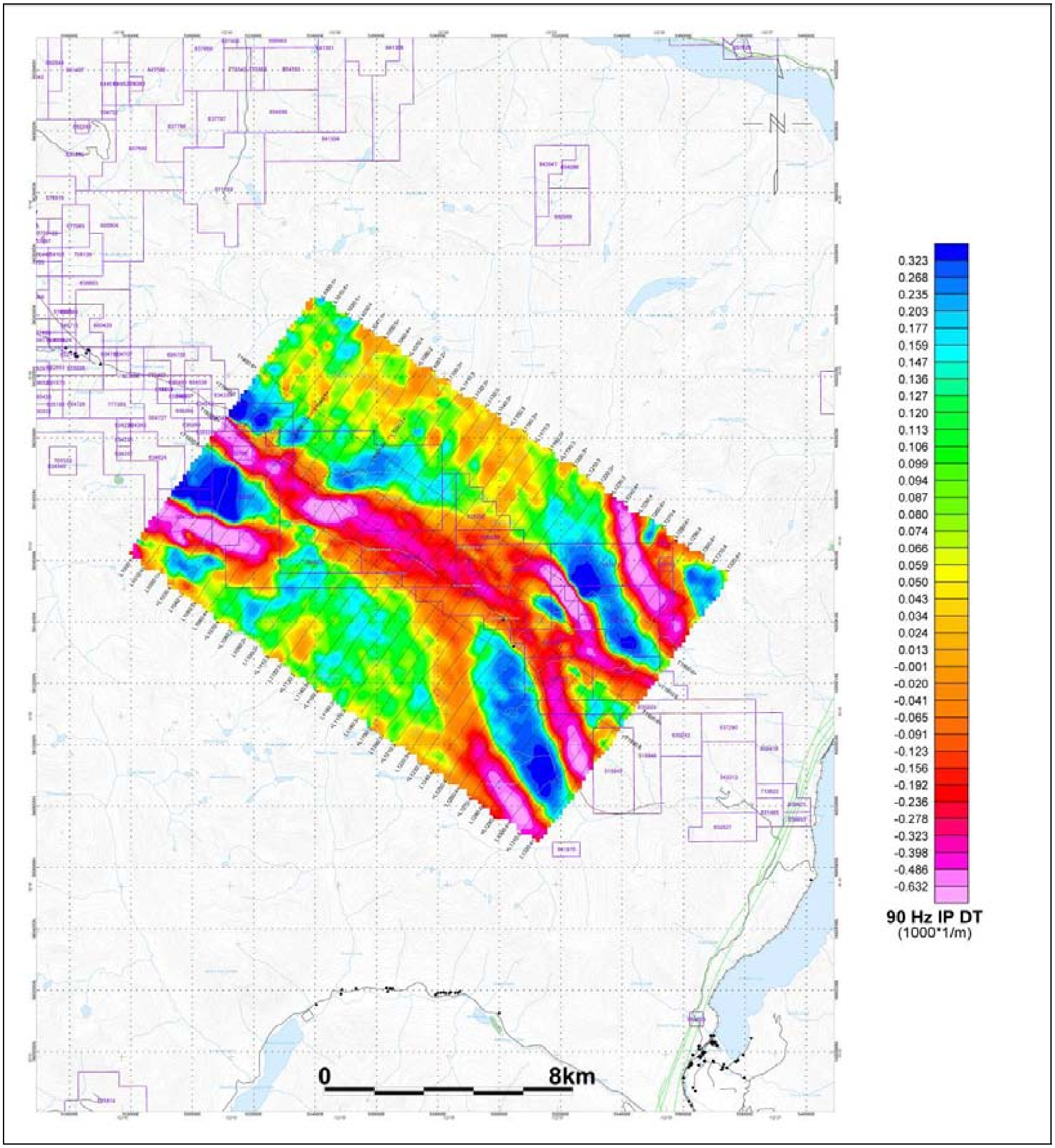
Tzx (In-line) Quadrature Profiles over 90Hz Rotated Tzx Quadrature Grid



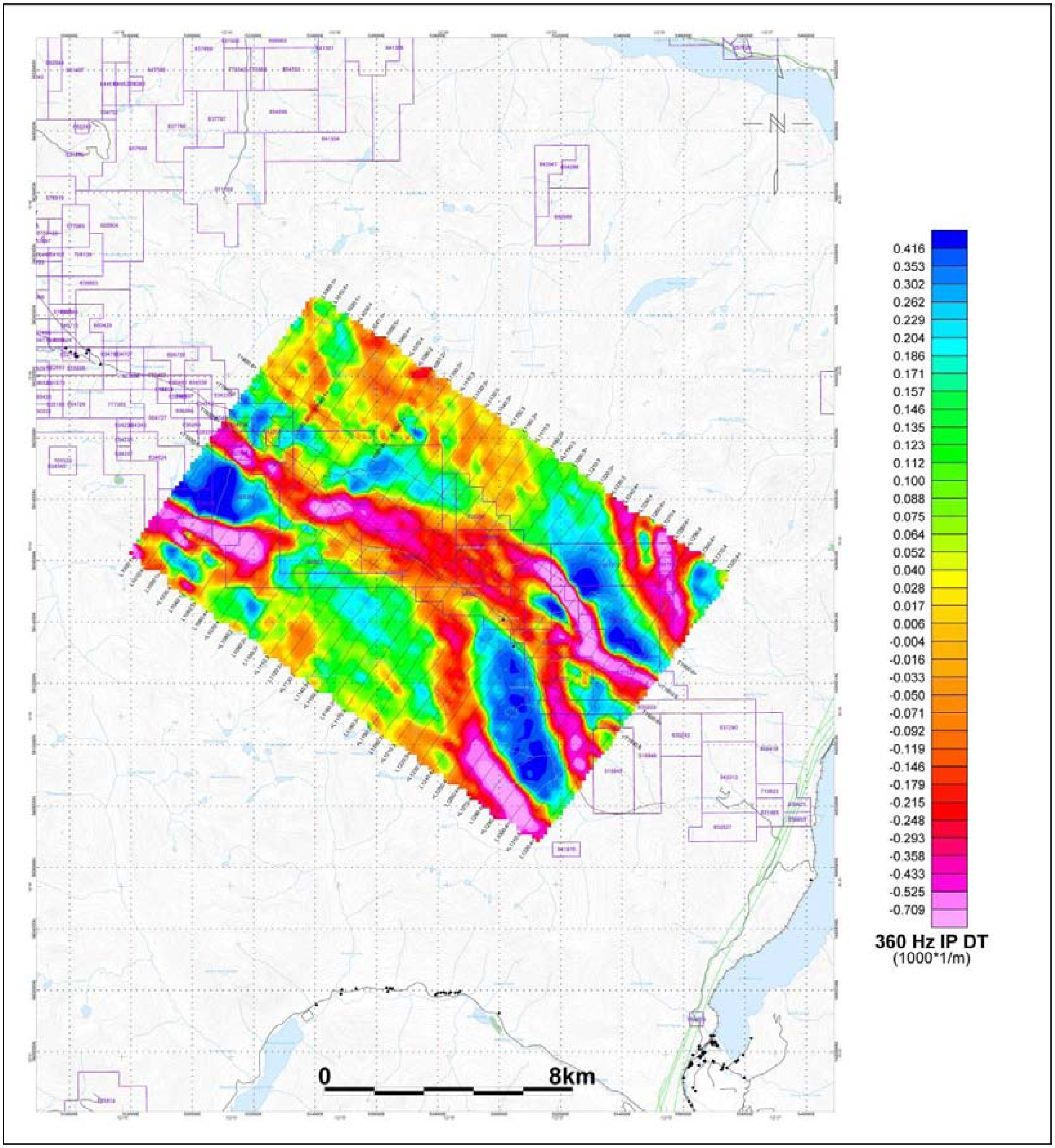
Tzy (Cross-line) Quadrature Profiles over 90Hz Rotated Tzy Quadrature Grid



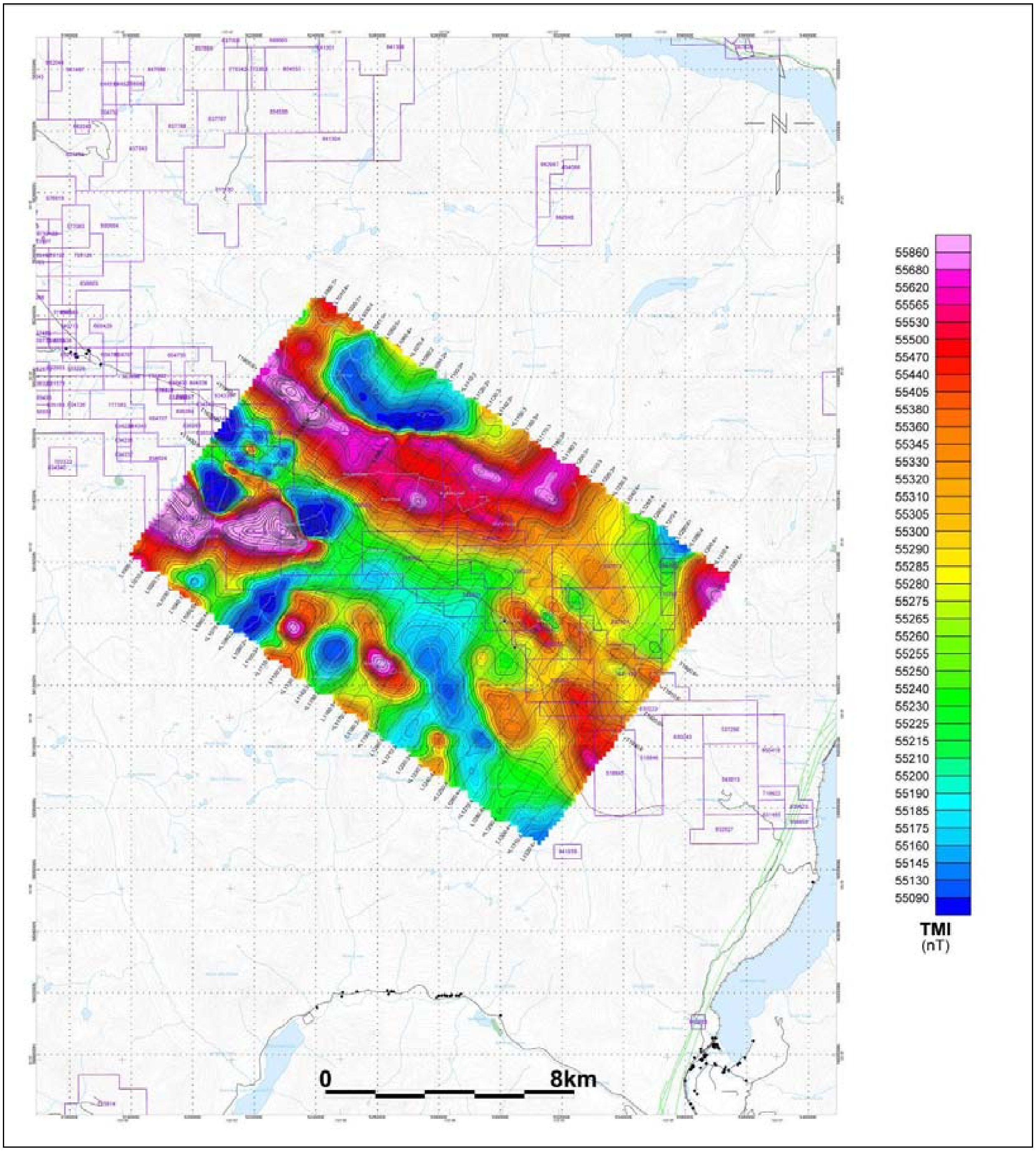
30Hz Total Divergence In-Phase (DT) Grid



90Hz Total Divergence In-Phase (DT) Grid



360Hz Total Divergence In-Phase (DT) Grid



Total Magnetic Intensity (TMI)

APPENDIX D

ZTEM THEORETICAL CONSIDERATIONS

A brief section on the theory behind the AFMAG technique is provided for completeness and a more comprehensive development of the theory can be found in standard texts. The natural EM field is normally horizontally polarized. Subsurface lateral variations of conductivity generate a vertical component, which is linearly related to the horizontal field. Although the fields look like random signals, they may be treated as the sum of sinusoids. At each frequency the field can be expressed as a complex number with magnitude and argument equal to the amplitude and phase of the sinusoid. The relation between the field components can then be expressed by a linear complex equation with two complex coefficients at any one frequency. These coefficients are dependent upon the subsurface and not upon the horizontal field present at any particular time and are appropriate parameters to measure (Vozoff, 1972).

$$\boxed{Hz(f) = Tx(f)\ Hx(f) + Ty(f)\ Hy(f), \qquad (1)}$$

Where

Hx(f), Hy(f) and Hz(f) are x, y and z components of the field,

Tx(f) and Ty(f) are the "tipper" coefficients.

In the case of a horizontally homogeneous environment, Tx and Ty are equal to zero because Hz =0. They show certain anomalies only by the presence of changes in subsurface conductivity in the horizontal direction. The real parts of the coefficients correspond to tangents of tilt angles measured with a controlled source. The complex tensor [Tx, Ty] known as the "tipper" defines the vertical response to horizontal fields in the x and y directions respectively.

Tx and Ty are two unknown coefficients in one equation, and we therefore must combine two or more sets of measurements to solve them. To reduce effects of noise, multiple sets of measurements can be made, and the coefficients, which minimize the squared error in predicting the measured Z from X and Y, can be found. This leads to next formulas for estimating the coefficients.

$$\boxed{Tx = ([HzHx^*]\ [HyHy^*] - [HzHy^*]\ [HyHx^*]) \,/\, ([HxHx^*]\ [HyHy^*] - [HxHy^*]\ [HyHx^*]), \qquad (2)}$$

and

$$\boxed{Ty = ([HzHy^*]\ [HxHx^*] - [HzHx^*]\ [HxHy^*]) \,/\, ([HxHx^*]\ [HyHy^*] - [HxHy^*]\ [HyHx^*]\ . \qquad (3)}$$

Where

[HxHy*] (For example) denotes a sum of the product of Hx with the complex conjugate of Hy.

In practical processing algorithms, all numbers Hx, Hy and Hz can be obtained by applying the same digital band-pass filters to three incoming parallel data signals. FFT algorithms are also applicable. All sums like [HxHy*] can be calculated on the basis of a discrete time interval in the range from 0.1 to 1 sec or on a sliding time base.

Using platform attitude data in the EM data processing can be done at different stages of the signal processing. The most obvious idea is to transform parallel data from local coordinates of the platform into absolute geographical coordinates before the main signal processing procedure. Unfortunately, the proper algorithms of attitude data obtained, often require some post-processing algorithms such as using post-calculated accelerations based on GPS data etc. That is why it is preferable to treat x-y-z coordinates in formulas above in the local coordinate system of the platform and to recalculate resulting local tilt angles into a geographical or global coordinate system later, during the data post processing.

In weak field conditions where the level of the signal is comparable with input noise levels in preamplifiers, the bias in the estimated values of Tx and Ty caused by noise in the horizontal signals become substantial and can not be reduced by any averaging. This bias can be removed by the use of separate reference signals containing noise uncorrelated with noise in signals Hx and Hy. (Anav et al., 1976).

$$\mathbf{Tx = ([HzRx^*]\,[HyRy^*] - [HzRy^*]\,[HyRx^*]) \,/\, ([HxRx^*]\,[HyRy^*] - [HxRy^*]\,[HyRx^*]),} \tag{4}$$

and

$$\mathbf{Ty = ([HzRy^*]\,[HxRx^*] - [HzRx^*]\,[HxRy^*]) \,/\, ([HxRx^*]\,[HyRy^*] - [HxRy^*]\,[HyRx^*]).} \tag{5}$$

Where:

Rx is the reference field x component,
Ry is the reference field y component.

An additional two electromagnetic sensors, providing these reference signals can be placed at some distance away from the main x, y and z sensors. Currently, though, no additional remote-reference processing are applied to ZTEM data.

Numerical Modelling

In order to understand the airborne AFMAG responses to conductors for a variety of geological environments, EMIGMA^{TM} modelling code from PetRos EiKon (Toronto, ON) was obtained to conduct the formulated model studies.

Below are some of the modelling results from their study.

Modelling assumption:

The assumptions for the modelling are that:

3 components of the magnetic field are measured and they are processed according to:

$$Hz(f) = Tx(f)\,Hx(f) + Ty(f)\,Hy(f)$$

The vector (Tx,Ty) is usually referred to as the ‘tipper’ vector and is determined in the frequency domain through processing. This is normally done by determining transfer functions from an extended time series.

For the modelling exercise, the 3 components of the magnetic vector (Hx,Hy,and Hz) are modelled twice for 2 orthogonal polarizations of a plane wave source field and then the tipper is calculated from a matrix calculation using the results of the 2 source polarizations’ models. For the 2D forward modelling results, the tipper vectors are shown as a function of frequency

Basic Model Response

For the initial models, we assume a thin plate-like model. The model is perpendicular to the flight direction. Initially, we will assume very long strike directions. From this quasi-2D model, there are 2 basic responses. The so-called TE response and the so-called TM response.

For the initial models, we will assume the strike is in the y (North) directions and the flight is in the x (East) direction Sensor heights are 30m above ground.

TE Mode: For the TE response, the electric field excitation flows along strike (current channelling) and the horizontal H field (Hx) flows perpendicular to strike thus causing induction through Faraday’s law. The Hz response is generated both from channelling and induction.

TM Mode: For this response, the electric field excitation flows perpendicular to strike generating quasi-static charges on faces and the horizontal H field (Hx) flows parallel to strike. Since, the XZ face is very small for this model, little current is induced. The charges on the faces have a small dipole moment due to the thinness of the model.

For the rest of the models unless otherwise noted, the parameters used are:

Strike Length: 1km
Depth Extent: 1km
Conductance: 100S
Depth to Top: 10m
Background: Thin-overburden (10m), Resistive Basement (1000 Ohm-m)

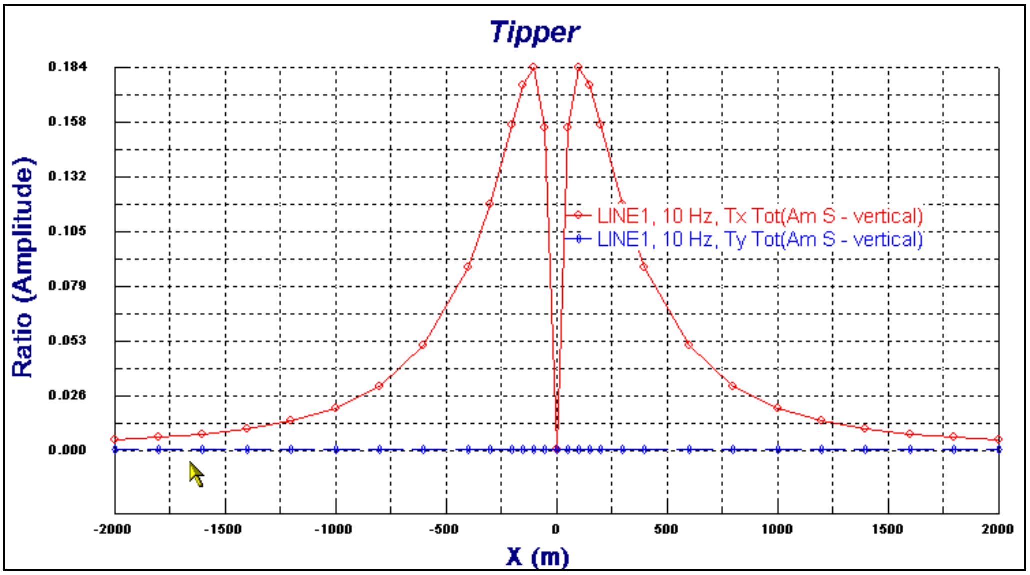


Figure D-1 – Calculated Tipper components at 10 Hz for above model parameters.

Figure D1 shows the Tipper (Tx,Ty) Amplitudes at 10Hz using a10Ωm overburden. Note small Ty (ie quasi-TM response)

Amplitude Response

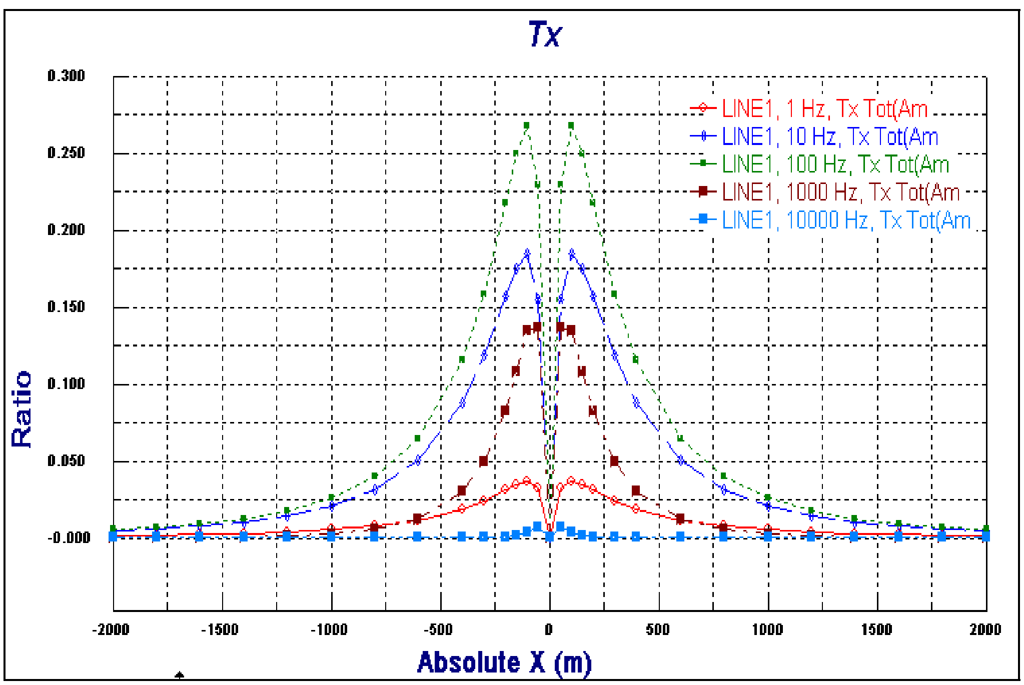


Figure D-2 – Calculated Tx component of the Tipper at various frequencies

The (Tx) response amplitude at 1,10,100,1000,10000 Hx. Peak amplitude at 100Hz

Inphase and Quadrature Response

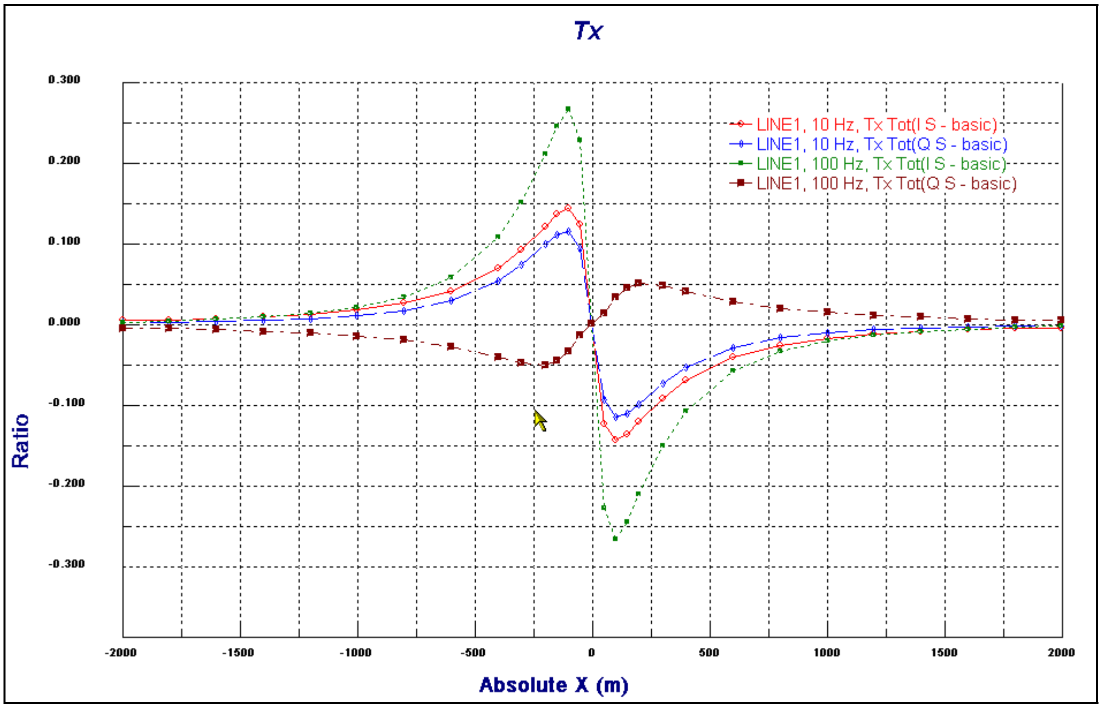


Figure D-3 – Calculated In-phase and Quadrature of the Tx component at various frequencies

Figure D-3 shows the In-phase and Quadrature response at 10 and 100Hz. Note the crossovers in the In-phase and Quadrature, and the phase reversal in the Quadrature responses from low to high frequencies.

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Geotech Ltd.
September, 2007

AFMAG Source Fields and ZTEM method[1]

AFMAG uses naturally occurring audio frequency magnetic fields as the source of the primary field signal, and therefore requires no transmitter (Ward, 1959). The primary fields resemble those from VLF except that they are lower frequency (tens & hundreds of Hz versus tens of kHz) and are usually not as strongly directionally polarized (Labson et al., 1985). These EM fields used in AFMAG are derived from world wide atmospheric thunderstorm activity, have the unique characteristic of being uniform, planar and horizontal, and also propagate vertically into the earth – to great depth, up to several km, as determined by the magnetotelluric (MT) skin depth (Vozoff, 1972), which is directly proportional to the ratio of the bedrock resistivity to the frequency (Figure D4).

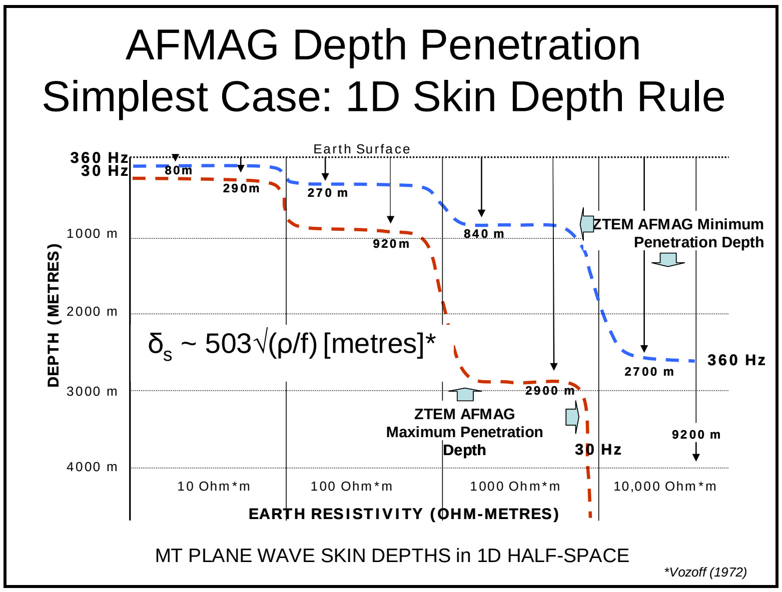

Figure D4: MT Skin Depth Penetrations for ZTEM in 30-360Hz and 10-1000 ohm resistivity

At the frequencies used for ZTEM, the penetration depths likely range between approx. 600m to 2km in this region (approx. 1k ohm-m avg. resistivity assumed), according to the following equation for the Bostick skin depth $\delta_B = 356 * \sqrt{(\rho / f)}$ metres (Bostick, 1977), which is considered appropriate as a rule of thumb equivalent depth estimate.

The other unique aspect of AFMAG fields is that they react to relative contrasts in the resistivity, and therefore do not depend on the absolute conductance, as measured using inductive EM systems, such as VTEM. Hence poorly, conductive targets, such as alteration zones and fault zones can be mapped, as well as higher conductance features, like graphitic units. Conversely, resistive targets can also be detected using AFMAG– provided they are of a sufficient size and contrast to produce a vertical field anomaly. Indeed resistors produce

[1] From: Legault, J.M., Kumar, H., and Milicevic, B. (2009): ZTEM tipper AFMAG and 2D inversion results over an unconformity uranium target in northern Saskatchewan, Expanded Abstract submitted to Society of Exploration Geophysics SEG conference, Houston, Tx, Nov-2009, 5 pp.

reversed anomalies relative to conductive features. Hence AFMAG can be effective as an all-round resistivity mapping tool, making it unique among airborne EM methods. A series of 2D synthetic models that illustrate these aspects have been created using the 2D forward MT modelling code of Wannamaker et al. (1987) and are presented in figures D5-D7.

The tipper from a single site contains information on the dimensionality of the subsurface (Pedersen, 1998), for example, in a horizontally stratified or 1D earth, $\boldsymbol{T}$=0 and as such H_Z is absent. For a 2D earth with the y-axis along strike, T_Y=0 and $H_Z = T_X$*H_X. In 3D earths, both T_X and T_Y will be non-zero. H_Z is therefore only present, as a secondary field, due to a lateral resistivity contrast, whereas the horizontal H_X and H_Y fields are a mixture of secondary and primary fields (Stodt et al., 1981). But, as an approximation, as in the telluric-magnetotelluric method (T-MT; Hermance and Thayer, 1975) used by distributed MT acquisition systems, the horizontal fields are assumed to be practically uniform, which is particularly useful for rapid reconnaissance mapping purposes. By measuring the vertical magnetic field H_X, using a mobile receiver and the orthogonal horizontal H_X and H_Y fields at a fixed base station reference site, ZTEM is a direct adaptation of this technique for airborne AFMAG surveying.

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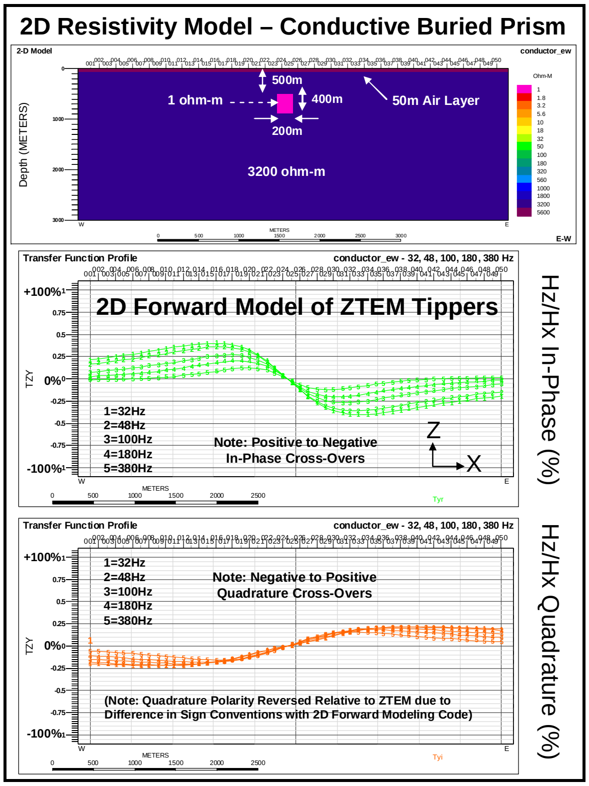

Figure D5: 2D synthetic forward model Tipper responses (Tzy) for conductive brick model.

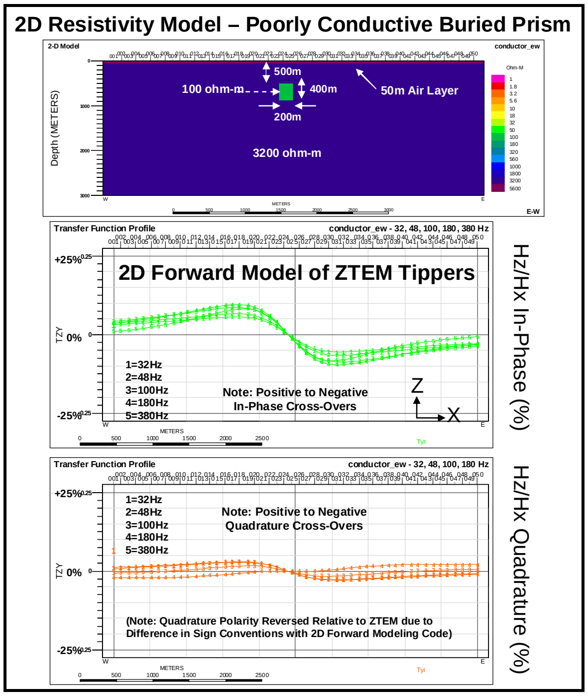

Figure D6: 2D synthetic forward model Tipper response (Tzx) for poorly conductive brick model.

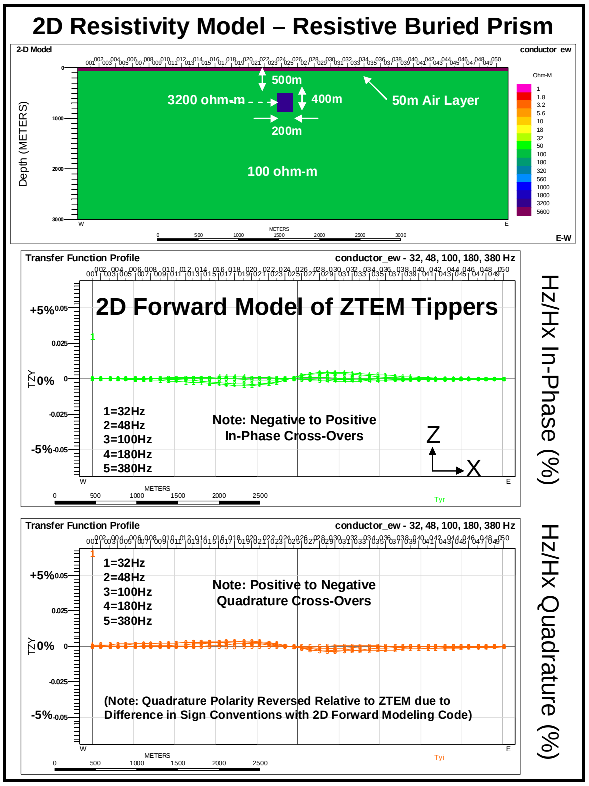

Figure D7: 2D synthetic forward model Tipper response (Tzx) for resistive brick model.

APPENDIX E

ZTEM (AIRBORNE AFMAG) TESTS OVER UNCONFORMITY URANIUM DEPOSITS[5]

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Key Words: ZTEM, AFMAG, electromagnetic, airborne, uranium, Athabasca.

INTRODUCTION

A series of demonstration tests were conducted using the ZTEM, airborne AFMAG system over deep targets in the Athabasca Basin of Saskatchewan, Canada. These tests were conducted in mid-2008 and were flown to test ZTEM's ability to detect large conductive targets at depth; deeper than conventional airborne EM methods. Data are presented over areas where the conductors are located 450-600 metres beneath the surface. As well, a case of ZTEM following the plunge of a conductor to over 800 metres depth is shown.

BACKGROUND

The ZTEM system is the latest implementation of an airborne AFMAG system first commercialized in late 2006. ZTEM uses a large, 8 metre diameter airborne air core coil, slung from a helicopter, to measure the vertical component of the AFMAG signal. Two 4 metre square coils are deployed on the ground to measure the horizontal field. The ZTEM system has flown successful demonstration surveys over porphyry copper deposits in the southwest USA (Zang et al., 2008).

ZTEM was tested in the Athabasca Basin in Canada in May of 2008 to determine its depth of investigation and to determine its suitability for mapping deep conductors in the crystalline basement. Over 30% of the world's U3O8 is mined in the Athabasca Basin from unconformity uranium deposits. Unconformity uranium deposits of the Athabasca Basin are often associated with conductors located in the crystalline basement. The search for economic uranium deposits is moving to areas of the basin which are deeper and beyond the detection limits of modern airborne instrumentation. This creates the requirement for a system which can detect conductivity past the detection limits of modern traditional EM systems. This was the motivation behind the field trials of the ZTEM system in the Athabasca Basin. Several areas where known deep conductors (450-600m+) were located were flown. Also, a test survey block in the northern part of the basin was able to trace a deep and plunging conductor to depths that no other airborne EM system has been able to achieve.

ATHABASCA BASIN GEOLOGY

The high-grade uranium deposits within the Athabasca Basin are associated with the unconformity between the essentially flat-lying Proterozoic Athabasca Group sandstones and the underlying Archean-Paleoproterozoic metamorphic and igneous basement rocks. The deposits occupy a range of positions from wholly basement-hosted to wholly sediment-hosted, at structurally favourable sites in the interface between the deeply weathered basement and overlying sediments of the Athabasca Basin (Ruzicka, 1997). The locations of These deposits are lithologically and structurally controlled by the sub-Athabasca unconformity and basement faults and fracture zones, which are localized in graphitic pelitic gneisses that may flank structurally competent Archean granitoid domes (Quirt, 1989).

In general, most of the known important deposits tend to occur within a few tens to a few hundred metres of the unconformity and within 500 m of the current ground surface. This may be more of a limitation of exploration techniques. There is no reason to believe that the distribution of the deposits is dependent on the modern day depth of burial.
Empirically, the geophysical exploration for unconformity type uranium targets have been to search for large basement

[5] Extended abstract submitted to 20[TH] ASEG International Geophysical Conference & Exhibition, Adelaide, AU, 22-26 Feb, 2009.

structures which post date the sandstone deposition of the basement (Matthews et. al, 1997). All the deposits located so far are associated with fault structures associated with a graphitic conductive basement. An alteration zone of clay silicification and enrichment around the deposits probably leads to magnetite destruction causing the magnetic low observed around the deposits. The clay alteration should give rise to a resistivity low signature about the deposits. The low conductivity of the clay alteration makes it a difficult target for airborne EM if it is buried at significant depth.

ZTEM INSTRUMENTATION AND PRESENTATION

ZTEM is an airborne AFMAG system introduced by Geotech Ltd. of Canada in early 2007 (Lo et al., 2008). In a ZTEM survey, a single vertical dipole air-core coil is flown over the survey area in a grid pattern similar to other airborne electromagnetic surveys. Two orthogonal, air-core, horizontal axis coils placed close to the survey site measures the horizontal EM fields for reference. A GPS array on the airborne coil monitors its attitude for post-flight corrections.

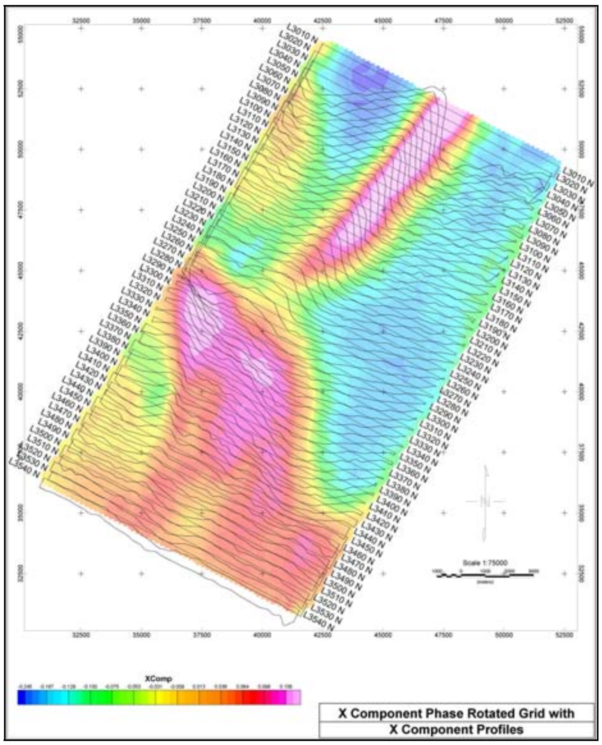

Figure 1 – Stacked profiles of the x-component Tipper over the gridded values of the phase rotated x-component data. Note that the cross-overs in the profiles are now peaks on the image.

As the source field is assumed to be far away, the excitation of the ground is more or less uniform. For large structures, the signal fall-off will be much slower than from a dipole source, such as those energized by traditional airborne systems. With the ZTEM system being less susceptible to terrain clearance, the planned ground clearance height is higher and the terrain drape is looser as compared to standard helicopter EM surveys.

The two Tippers obtained from the relationship between the vertical airborne coil and the two ground coils have a cross-over over a steeply dipping, plate-like body. The cross-overs can be made into local maxima via a 90 degree phase rotation which allows for easier interpretation of the gridded values. Figure 1 is an example of this transformation.

To present the data of both Tippers as one image, we calculate a parameter termed the DT which is the horizontal divergence of the two Tippers, much in the same manner as the “peaker” parameter in VLF (Pedersen, 1998). The DT is typically plotted with an inverted colour bar as it is negative over a steeply dipping thin body.

ZTEM RESULTS – NORTHERN ATHABASCA BASIN

Figure 2 shows gridded values from a number of ZTEM lines over an area where the sedimentary cover is approximately 450-600 metres thick. A number of traditional EM systems have also been flown over this block. While they were able to detect conductors, the resolution of the conductive features is not nearly as detailed as the information provided by ZTEM.

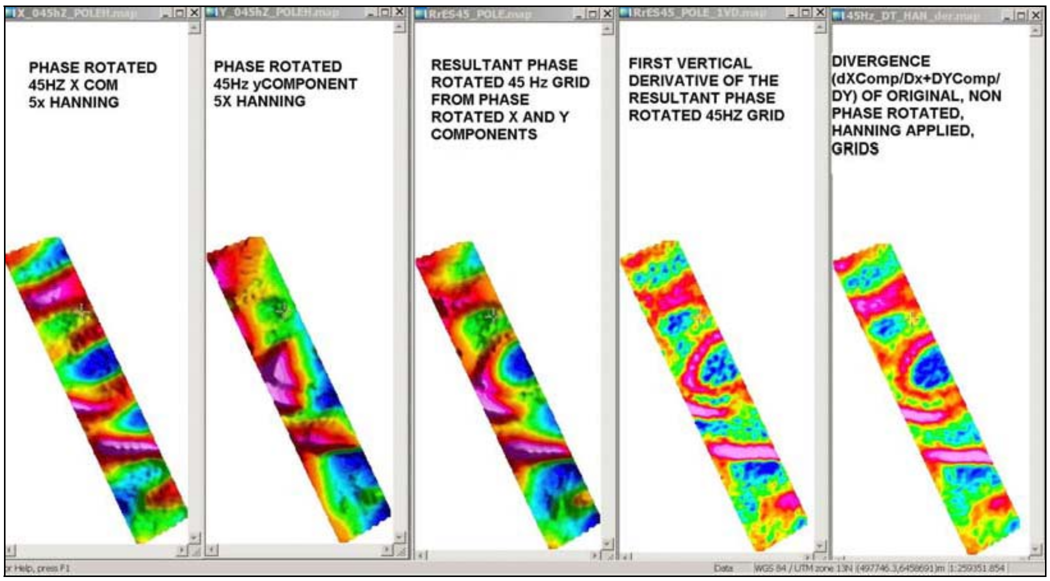

Figure 2 – ZTEM results over an area of 450-600 metre thick sedimentary cover.

Figure 3, from another area, shows the data from one of the larger blocks that was flown. It is a 3D composite image of the DT at various frequencies plotted at the equivalent skin depth assuming a 1,000 ohm-m average resistivity.

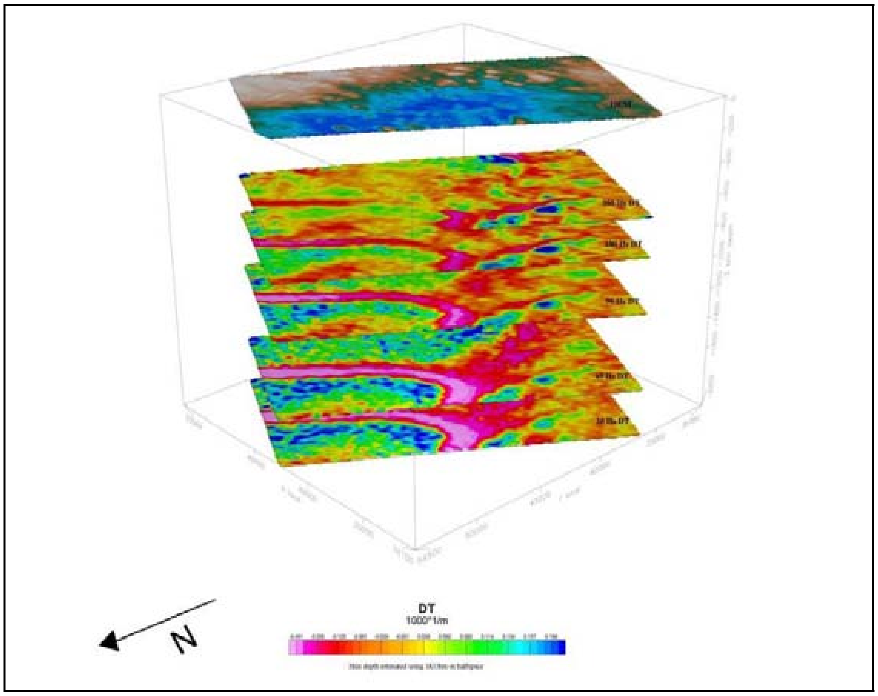

Figure 3 - Perspective view of DT's of different frequencies plotted at the skin depth (using a 1,000 ohm-m Earth.

The data in Figure 3 come from a survey over the north rim of the Athabasca Basin. The sandstone cover is about 500m on the left hand side of the image, and progressively getting deeper to the right. It is about 700m in the middle part of the image and over 800 metres thick on the right middle portion where exploration drilling is concentrated. Starting in the middle left and trending to the right of the image, there is a known graphitic shear.

In the uppermost (600m) "depth slice", Figure 3 shows a linear conductive feature that progressively weakens as one moves to the right until it is no longer seen. This is interpreted to be due to the graphitic shear conductor plunging deeper past the depth of investigation of the 360 Hz data. The lower frequencies penetrate more into the sedimentary cover that is deeper towards the right. DT's of decreasing frequency show the linear conductive feature extending more and more to the right. The feature also strengthens/sharpens into a synformal shape with lower frequencies. This fits with what the known geology of a plunging conductor at depth is doing.

At the nose of the fold, in the right third of the images, we also see another, broader anomalous zone that trends towards the back of the image. At this location, two radioactive springs are situated. These spring waters which are anomalously high in uranium and radon may reflect the upward migration of deep waters along faults, suggesting structural targets in areas where basinal waters may have tapped a radioactive source. This broad DT trend might be the plunge of the fold axis that is aligned away from the front of the image. An anomaly along this trend, at the highest frequency, that steadily grows with each decreasing frequency can be seen. This might represent an alteration zone in the sandstone that is detected at the shallowest depth. By about the 90Hz DT depth slice or so, we are possibly in the deeper basement and into a basement graphitic unit.

CONCLUSIONS

A number of successful ZTEM tests were conducted over the Athabasca Basin. The tests demonstrated that ZTEM can easily detect conductivity to 800 metres beneath relatively resistive sedimentary cover. Assuming a 1,000 ohm-metre resistivity, the skin depth of the 30 Hz data is approximately 2,000 metres. The 30 Hz data presented have good signal to noise ratios indicating a deep depth of exploration. The observation that ZTEM may be detecting the clay alteration above the crystalline basement is a significant advantage for exploration of unconformity uranium deposits.

More demonstration surveys are planned in the Athabasca Basin later this year. And more target types for testing are also planned.

ACKNOWLEDGEMENTS

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APPENDIX F

2D Inversions

2D ZTEM Inversion Results

of

Royalle Property
Gold Bridge, British Columbia

For:
Worthington Resources Ltd.

Project 11059

By:

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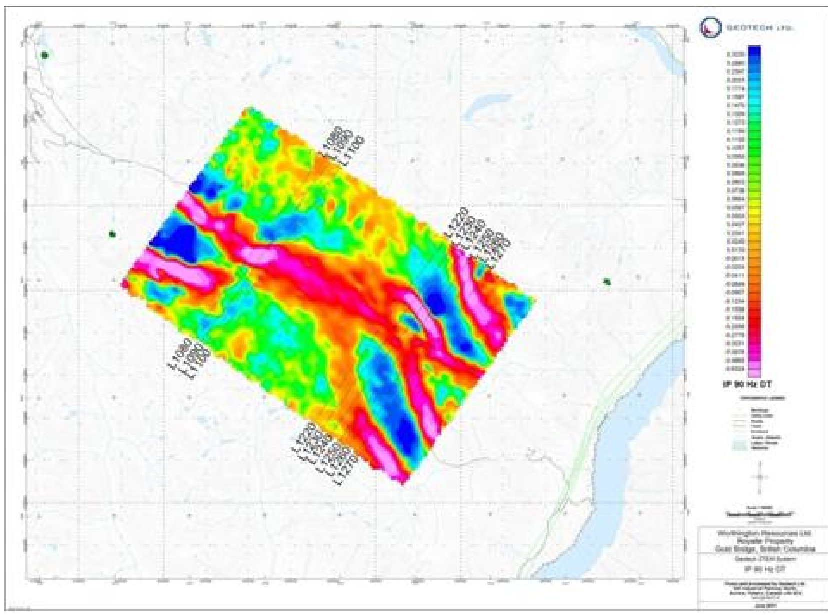
July, 2011

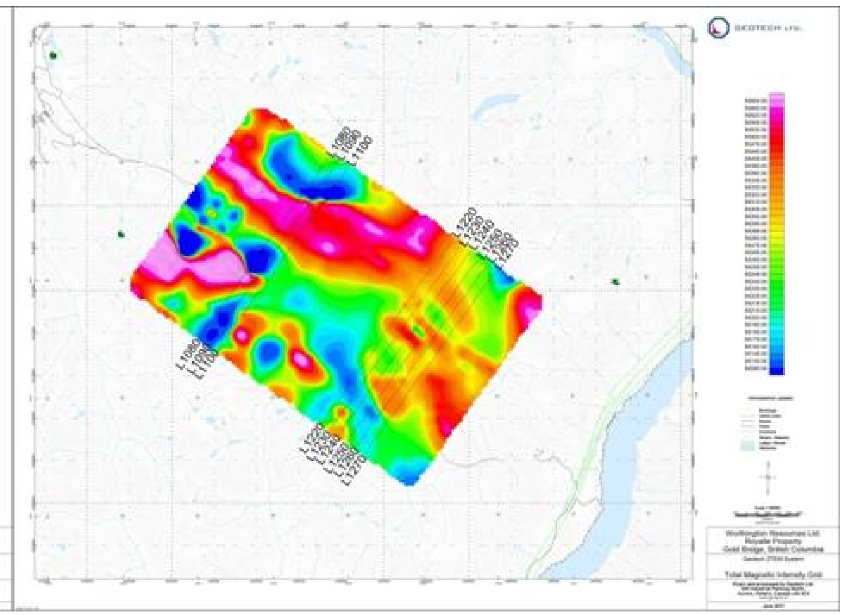
Summary

- Geotech Av2dtopo program was used to perform the inversion of ZTEM data (Tzx in-line) with topography and receiver altitude effects considered.
- The DEM topography and alt_b receiver altitude data used in the inversions were derived using the available SRTM data obtained from Geosoft DAP server
- Total 9 lines of data were inverted.
- 1000 ohm-m (chosen arbitrarily) start models and 5 frequencies (30, 45, 90,180, and 360 Hz) of data (In-Phase & Quadrature) were used for all lines.
- Slide 3 shows the inverted line locations over In-Phase (IP) 45Hz DT image and TMI image.
- Slides 4 to 12 show the inversion results, the inversion parameters, and the line location over IP 90Hz DT image for each line.

Line locations over IP 90 Hz DT image

Line locations over Magnetic TMI image





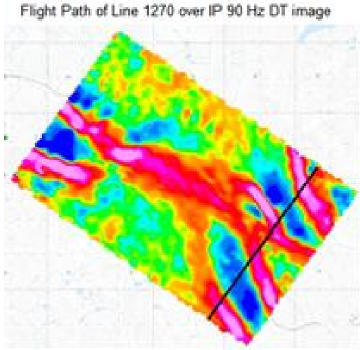
L1270, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

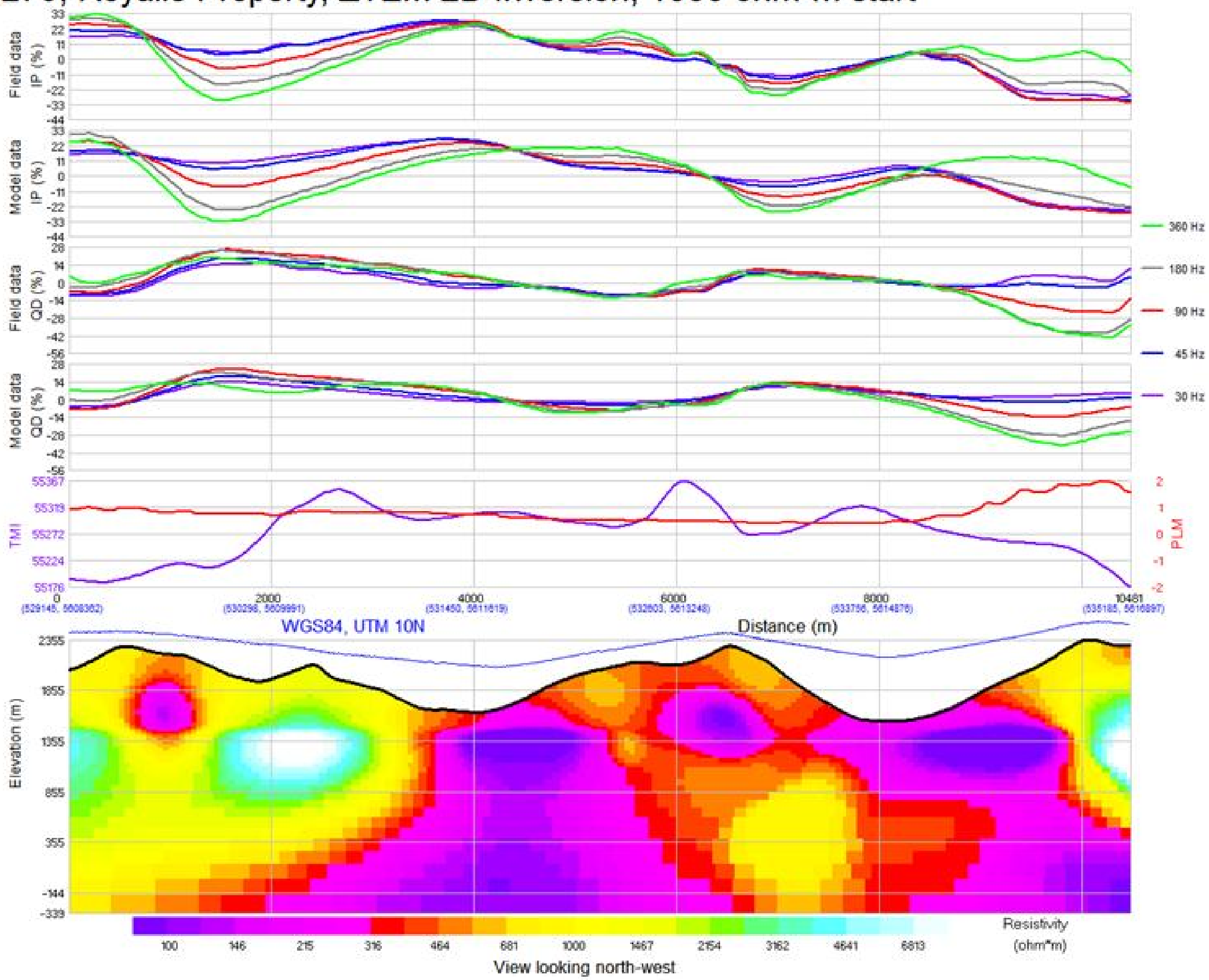
GEOTECH LTD.

2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.42 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.690 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 4.28 4.28 4.28 4.28 4.28
Half-space resistivity: 1000 ohm-m,
Output error: 0.999 RMS in 3 iterations

Flight Path of Line 1270 over IP 90 Hz DT image





Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1270 Flight 4, 2011/05/29
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2011/7/14

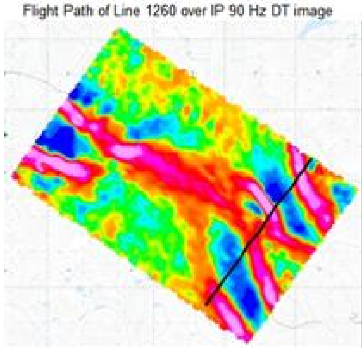
GEOTECH LTD.

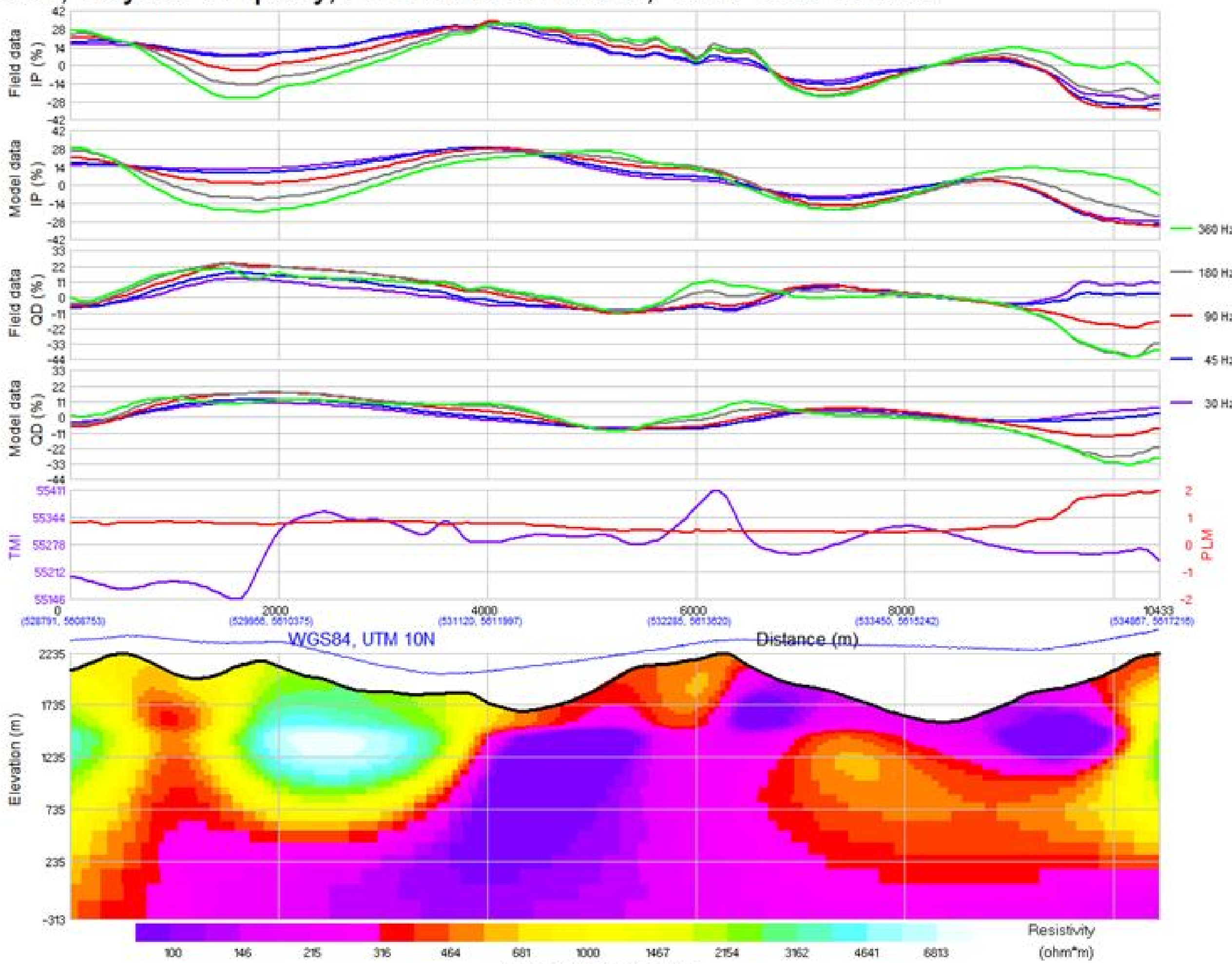
L1260, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.33 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.710 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 3.39 3.39 3.39 3.39 3.39
Half-space resistivity: 1000 ohm-m,
Output error: 0.998 RMS in 5 iterations

Flight Path of Line 1260 over IP 90 Hz DT image





View looking north-west

Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
Resistivity-Depth Image
Project 11059, Line 1260
Flight 4, 2011/05/29

Flown and processed by Geotech Ltd.
245 Industrial Parkway North
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

2011/7/14

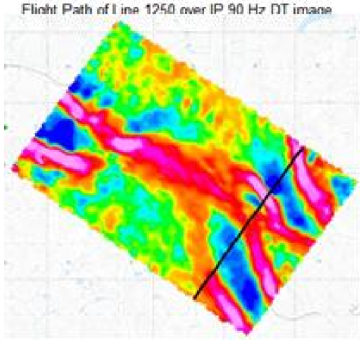
GEOTECH LTD.

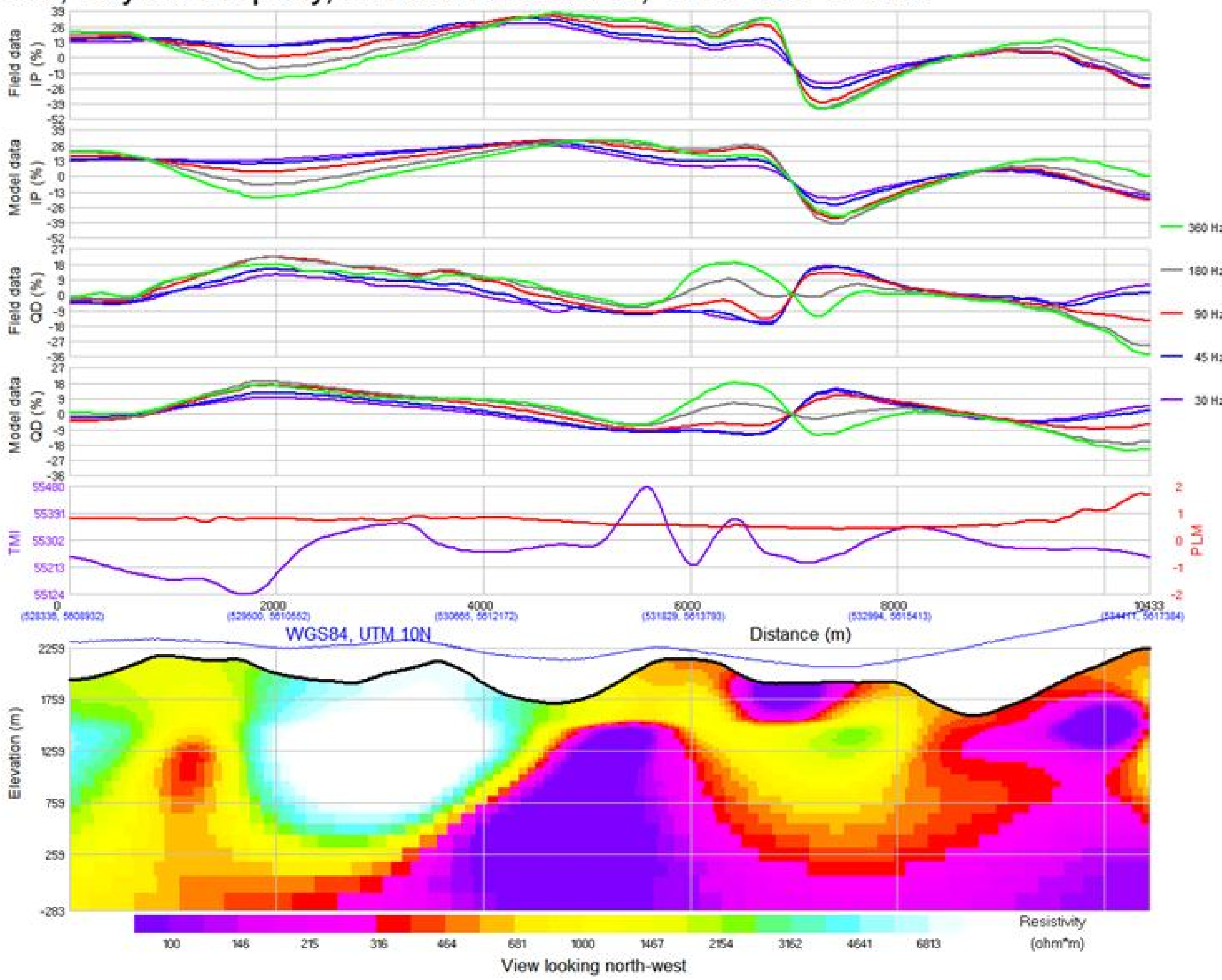
L1250, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.31 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.200 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 3.17 3.17 3.17 3.17 3.17
Half-space resistivity: 1000 ohm-m,
Output error: 0.998 RMS in 5 iterations

Flight Path of Line 1250 over IP 90 Hz DT image





Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1250 Flight 4, 2011/05/29
Flown and processed by Geotech Ltd. 245 Industrial Parkway North Aurora, Ontario, Canada L4G 4C4 www.geotech.ca
2011/7/14

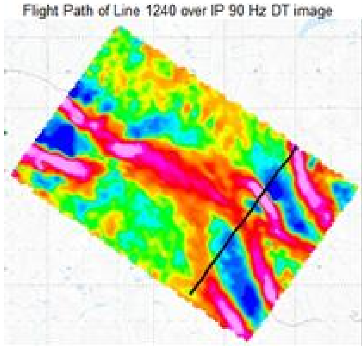
GEOTECH LTD.

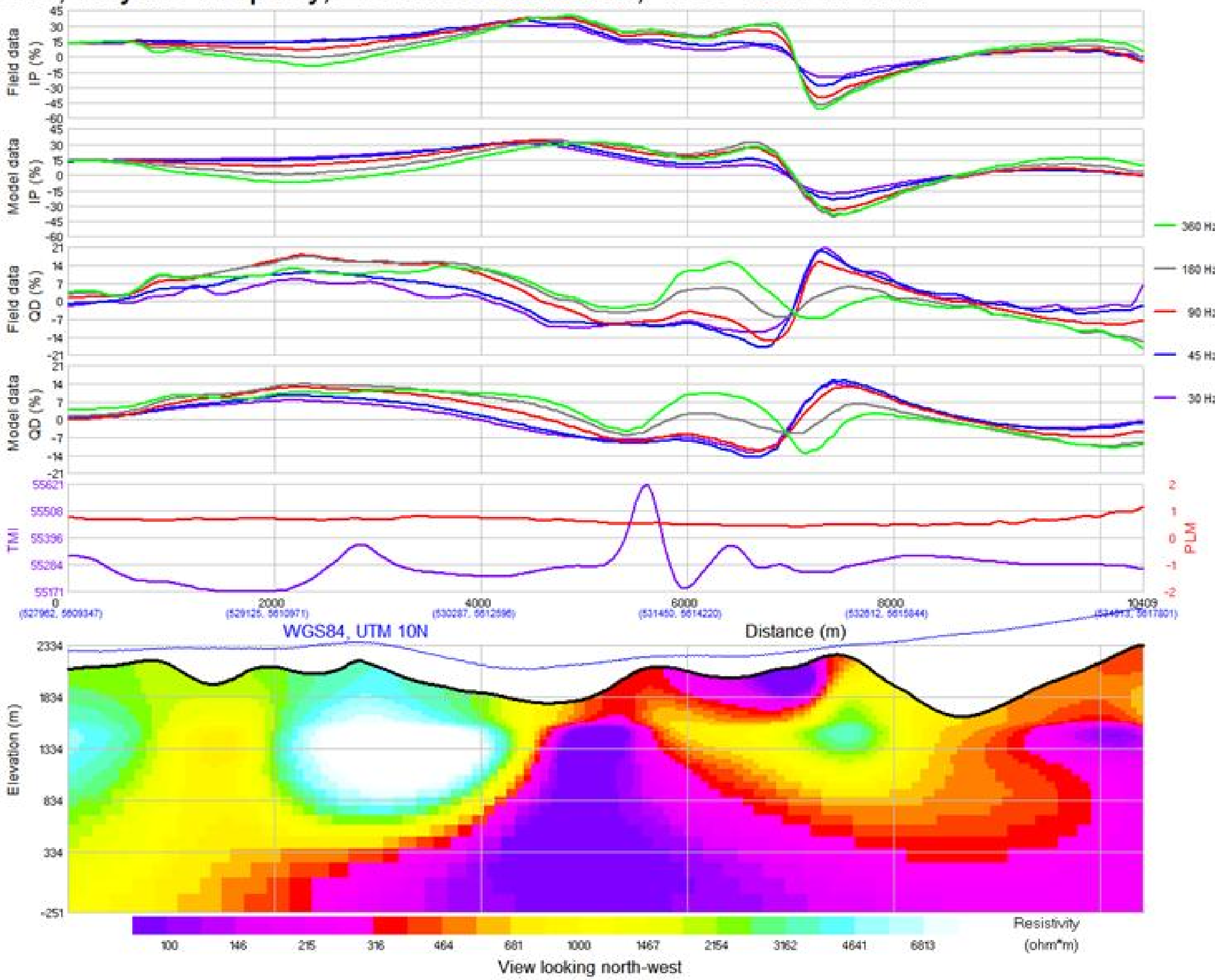
L1240, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.25 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.290 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 2.75 2.75 2.75 2.75 2.75
Half-space resistivity: 1000 ohm-m,
Output error: 0.999 RMS in 5 iterations

Flight Path of Line 1240 over IP 90 Hz DT image





Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1240 Flight 4, 2011/05/29
Flown and processed by Geotech Ltd. 245 Industrial Parkway North Aurora, Ontario, Canada L4G 4C4 www.geotech.ca
2011/7/14

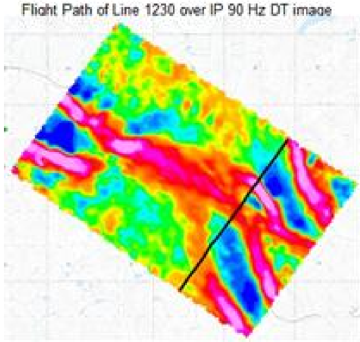
GEOTECH LTD.

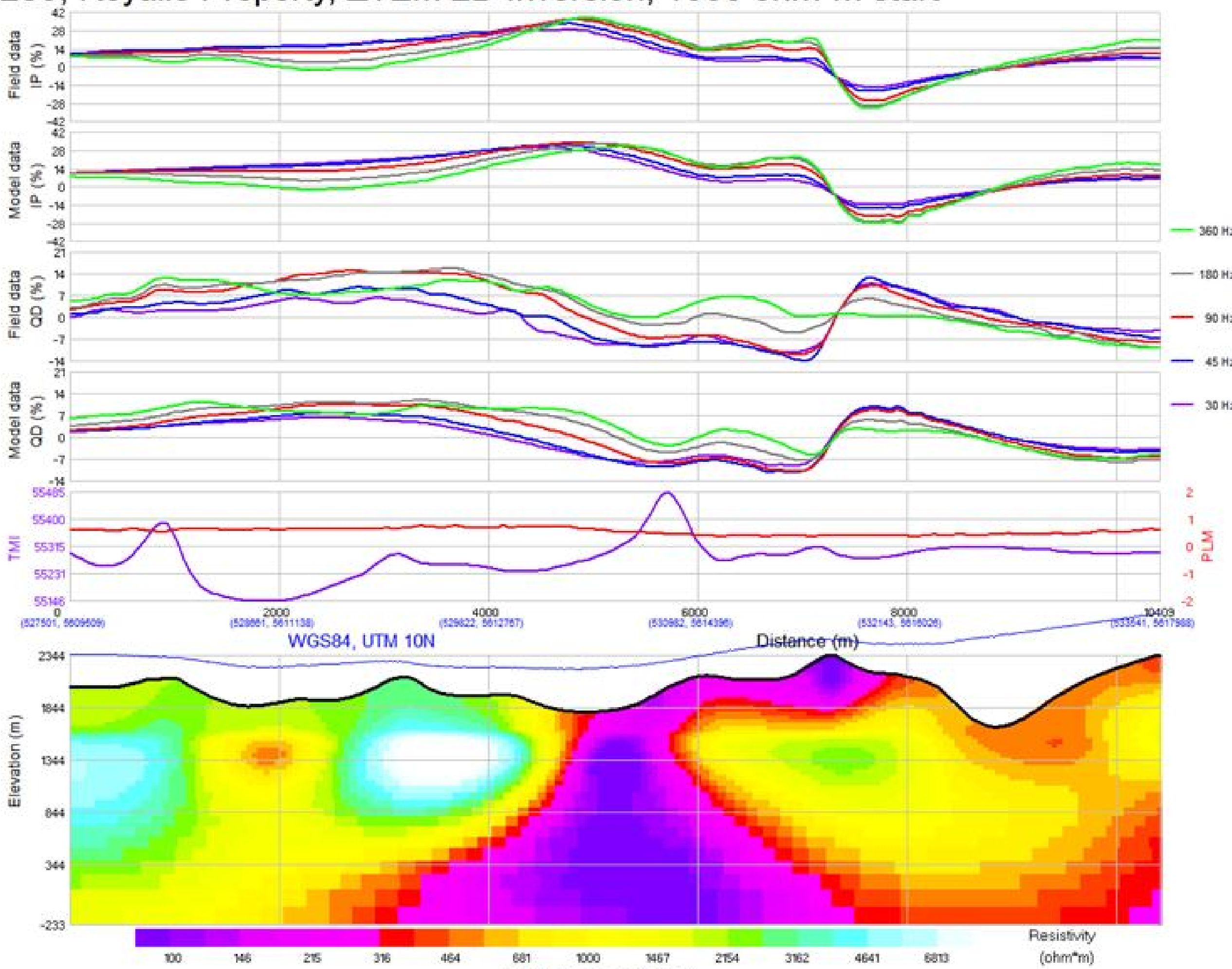
L1230, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.28 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.080 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 1.94 1.94 1.94 1.94 1.94
Half-space resistivity: 1000 ohm-m,
Output error: 0.996 RMS in 5 iterations

Flight Path of Line 1230 over IP 90 Hz DT image





View looking north-west

Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1230 Flight 3, 2011/05/29
Flown and processed by Geotech Ltd. 245 Industrial Parkway North Aurora, Ontario, Canada L4G 4C4 www.geotech.ca
2011/7/14

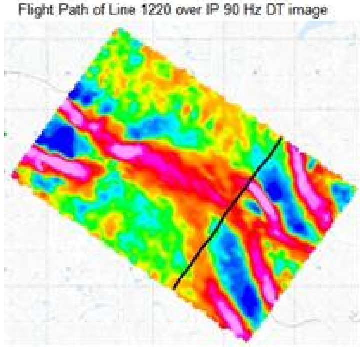
L1220, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

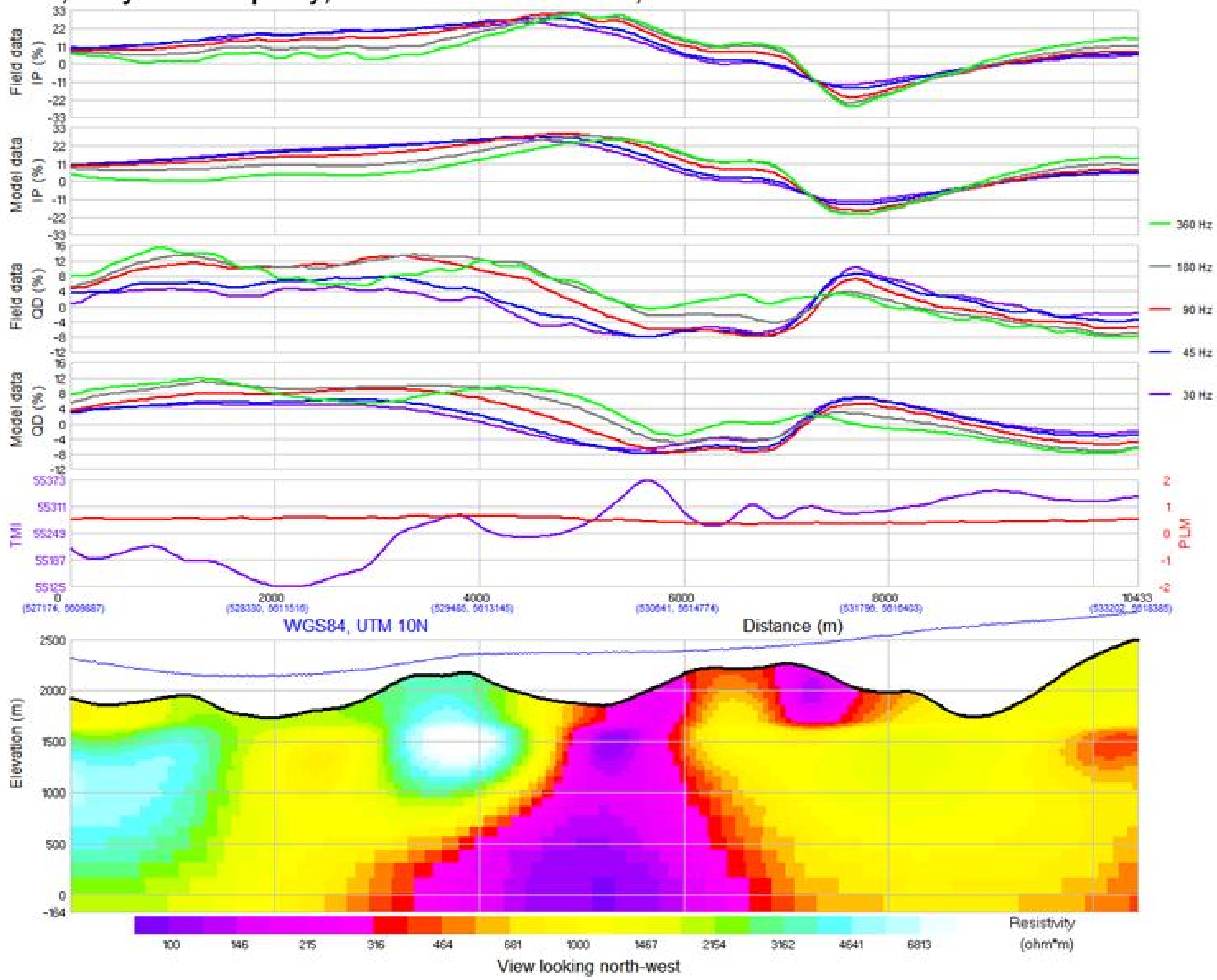
GEOTECH LTD.

2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.33 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 4.970 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 1.55 1.55 1.55 1.55 1.55
Half-space resistivity: 1000 ohm-m,
Output error: 0.995 RMS in 5 iterations

Flight Path of Line 1220 over IP 90 Hz DT image





Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1220 Flight 3, 2011/05/29
Flown and processed by Geotech Ltd. 245 Industrial Parkway North Aurora, Ontario, Canada L4G 4C4 www.geotech.ca
2011/7/13

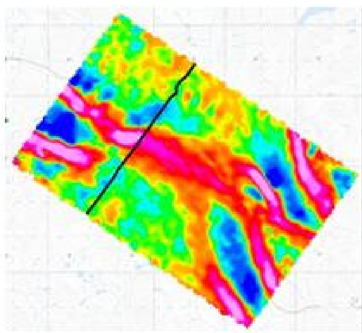
GEOTECH LTD.

L1100, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

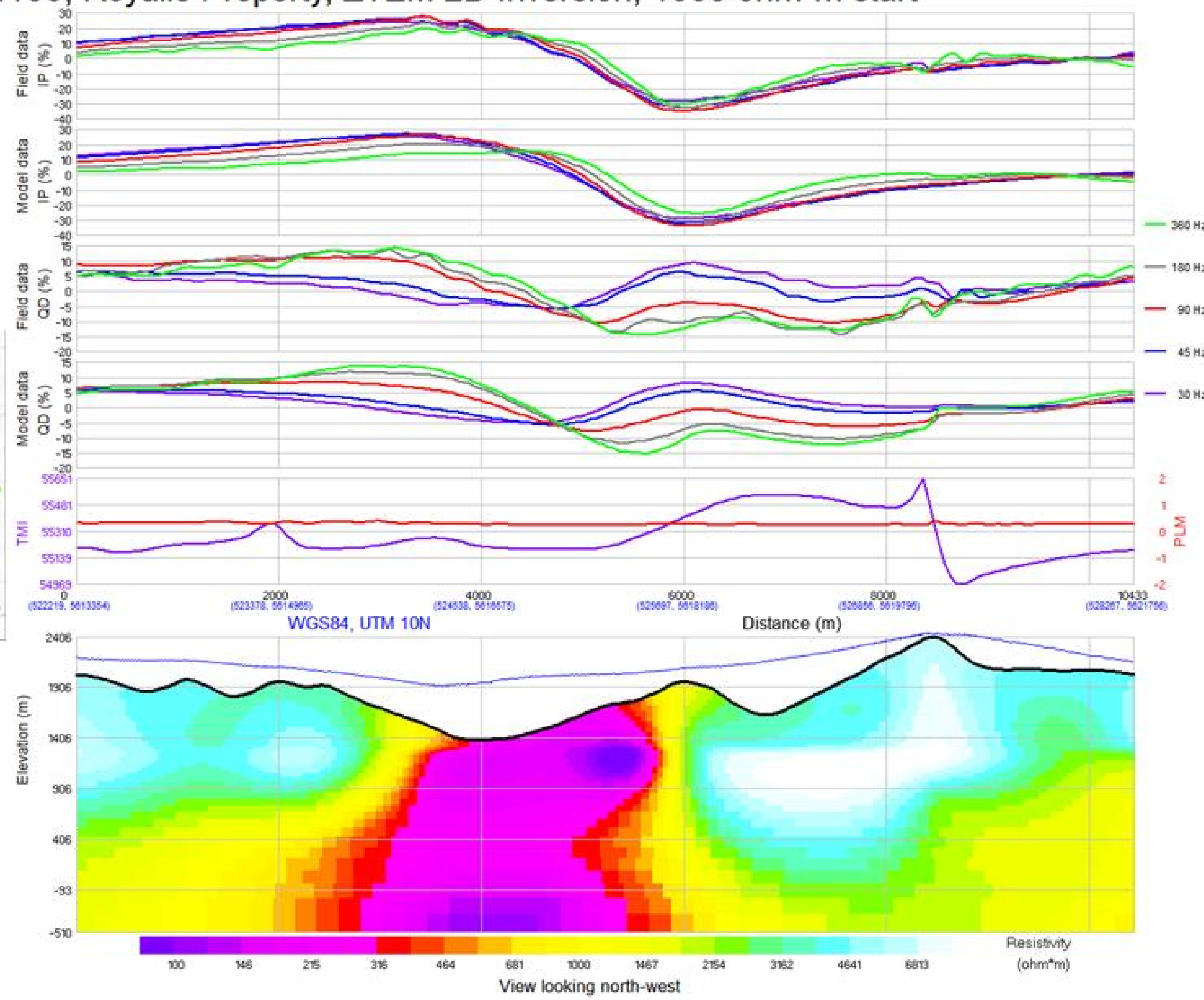
2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.34 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.700 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 1.62 1.62 1.62 1.62 1.62
Half-space resistivity: 1000 ohm-m,
Output error: 0.998 RMS in 5 iterations

Flight Path of Line 1100 over IP 90 Hz DT image



Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1100 Flight 3, 2011/05/29
Flown and processed by Geotech Ltd. 245 Industrial Parkway North Aurora, Ontario, Canada L4G 4C4 www.geotech.ca
2011/7/13



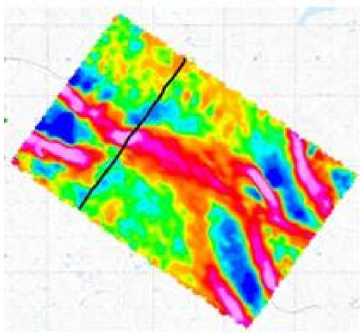
L1090, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

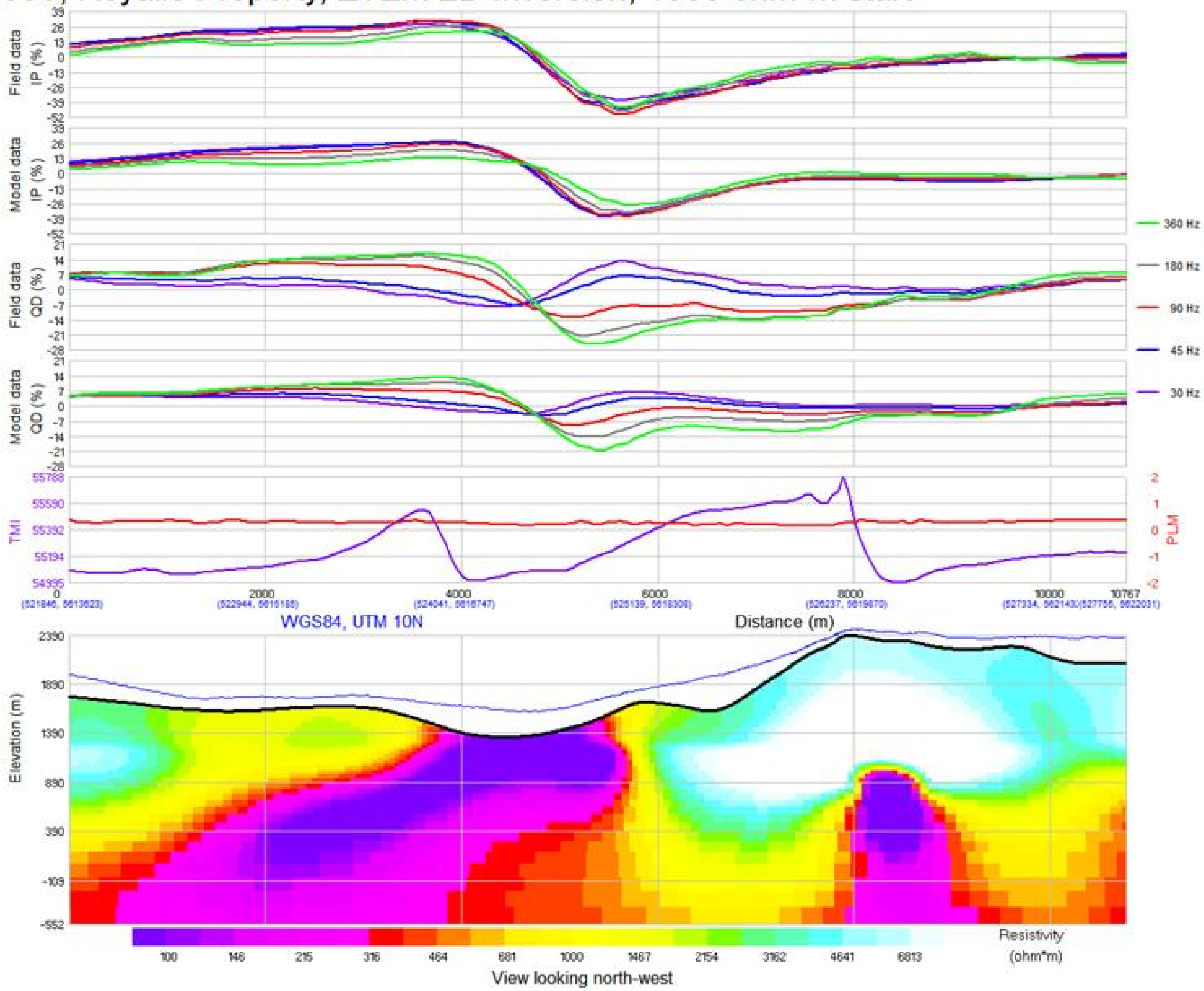
GEOTECH LTD.

2D INVERSION PARAMETERS

Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 28.16 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.520 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 1.00 1.00 1.00 1.00 1.00
Half-space resistivity: 1000 ohm-m,
Output error: 4.551 RMS in 5 iterations

Flight Path of Line 1090 over IP 90 Hz DT image





Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1090 Flight 2, 2011/05/25
Flown and processed by Geotech Ltd. 245 Industrial Parkway North Aurora, Ontario, Canada L4G 4C4 www.geotech.ca
2011/7/14

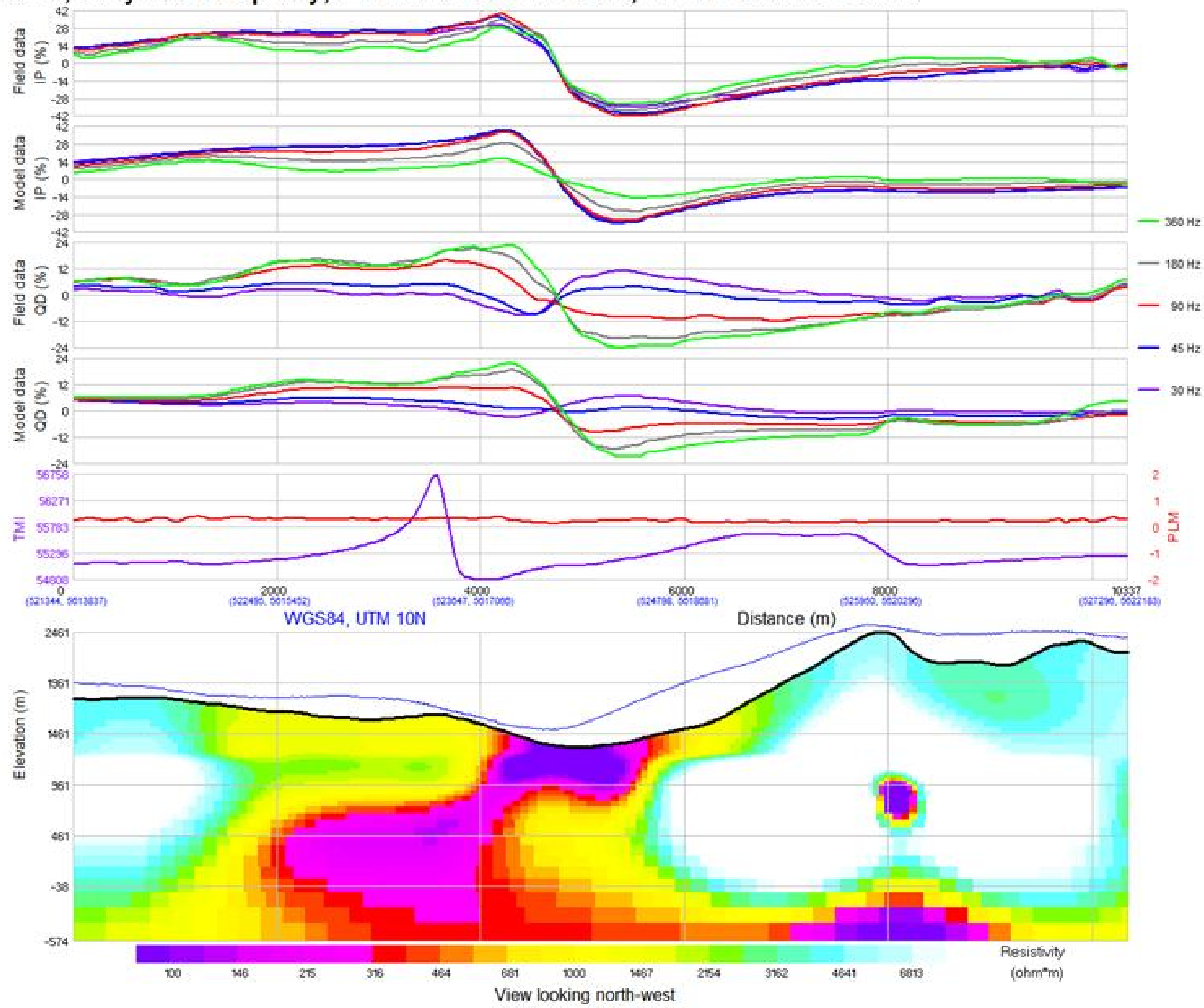
L1080, Royalle Property, ZTEM 2D Inversion, 1000 ohm-m start

GEOTECH LTD.

2D INVERSION PARAMETERS

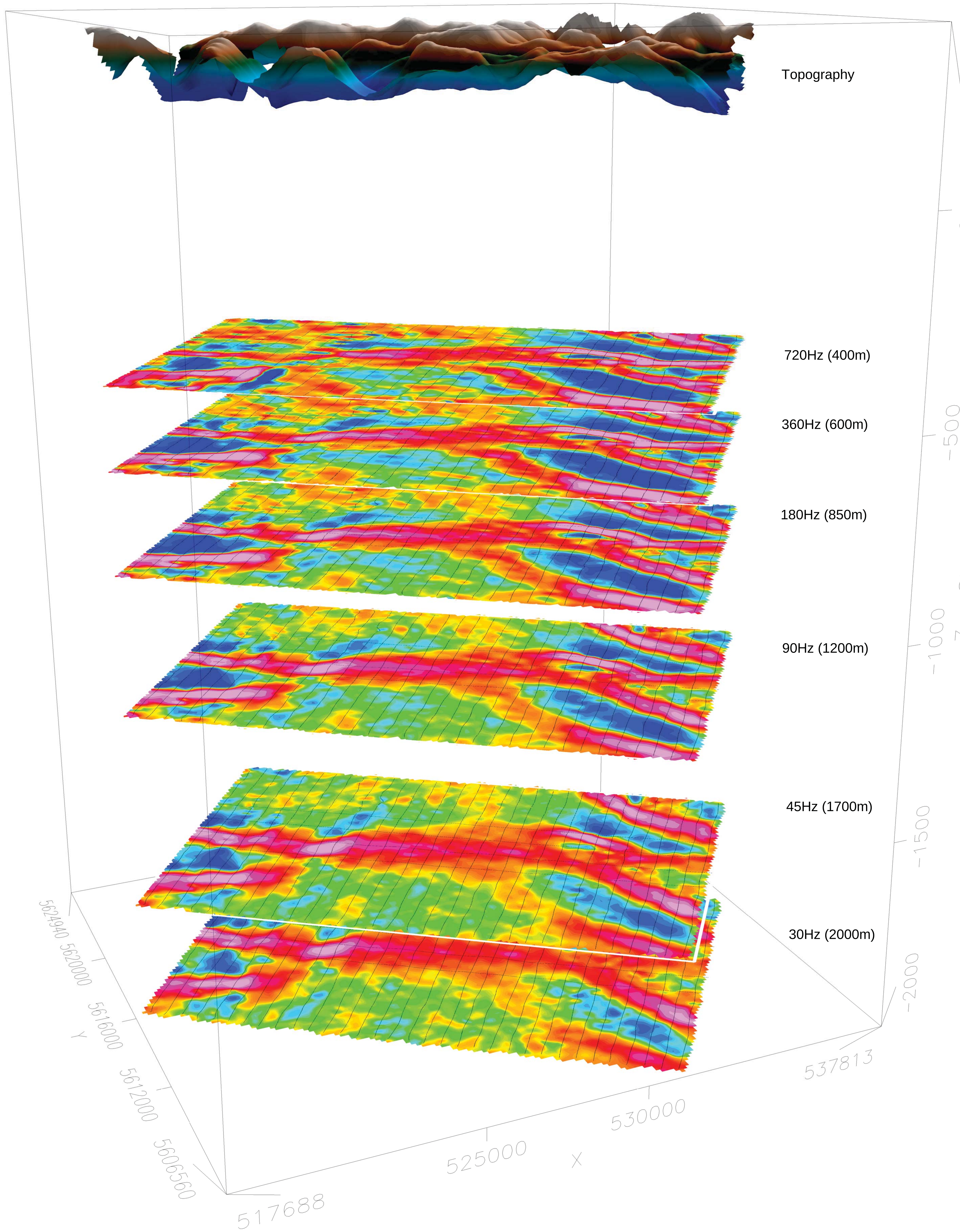
Inversion code: Geotech AV2DTOPO
Model Mesh: 440 wide x 112 vertical,
Average cell width: 27.09 m
2 cells between sites
Input Data: In-Phase & Quadrature,
Tzx In-line (only)
Average sampling rate: 5.780 points,
Total data points: 1920
Frequency (Hz): 30 45 90 180 360
Input error(%): 4.93 4.93 4.93 4.93 4.93
Half-space resistivity: 1000 ohm-m,
Output error: 0.999 RMS in 5 iterations

Flight Path of Line 1080 over IP 90 Hz DT image



Worthington Resources Ltd. Royalle Property Gold Bridge, British Columbia
Geotech ZTEM System Resistivity-Depth Image Project 11059, Line 1080 Flight 2, 2011/05/25
Flown and processed by Geotech Ltd. 245 Industrial Parkway North Aurora, Ontario, Canada L4G 4C4 www.geotech.ca
2011/7/13

GEOTECH LTD.



Skin Depth Calculated for a 1000 ohm-m Half Space Model
Z multiplier of 12, Scale Factor 0.15, Inclination = 12, Declination = 24

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
Nominal Survey Line Direction: N 35° E / N 215° E
Nominal Survey Tie Line Spacing: 1000 Meters
Nominal Survey Tie Line Direction: N 125° E / N 305° E
Helicopter Mean Terrain Clearance: 297 metres
Mean Ground Air Speed: 25 metres/sec
ZTEM airborne coil: towed at a mean distance of 70 m below the helicopter
Airborne Magnetometer bird: towed at a mean distance of 55 m below the helicopter

HELICOPTER SPECIFICATIONS

Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
Coil dimensions: 3.5 metres each side
Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

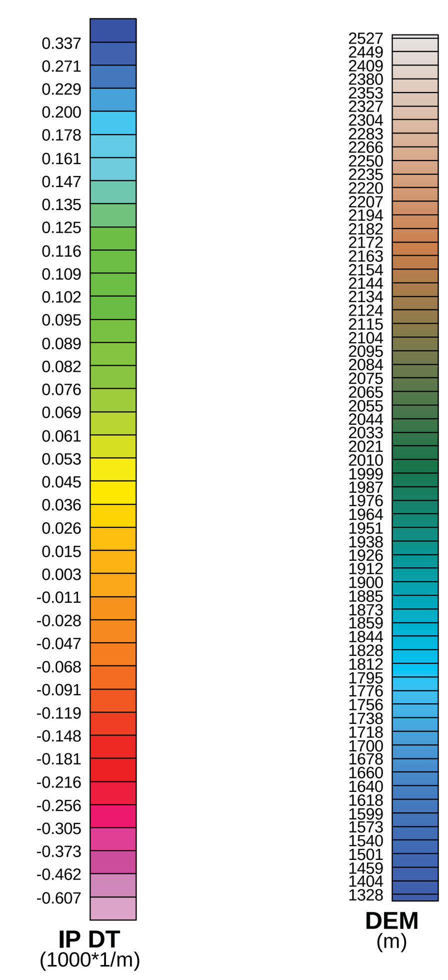
Diurnal Subtraction, microlevelling

ZTEM:

Frequencies extracted: 30, 45, 90, 180, 360, 720Hz.
Sampling rate: 0.4 sec.
Rotation of the inphase part of the inline and orthogonal components (Z/Xloc and Z/Yloc)on to UTM Eastings and Northings.
Attitude correction applied, (calculated from 3 GPS recievers installed on aiborne coil).
DIV(Tilt) calculated: dXcomp/dX+dYcomp/dY for all 6 frequencies.
Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16



Scale 1:50000

500 0 500 1000 1500 2000 2500

(meters)

NAD 83/ UTM zone 10N

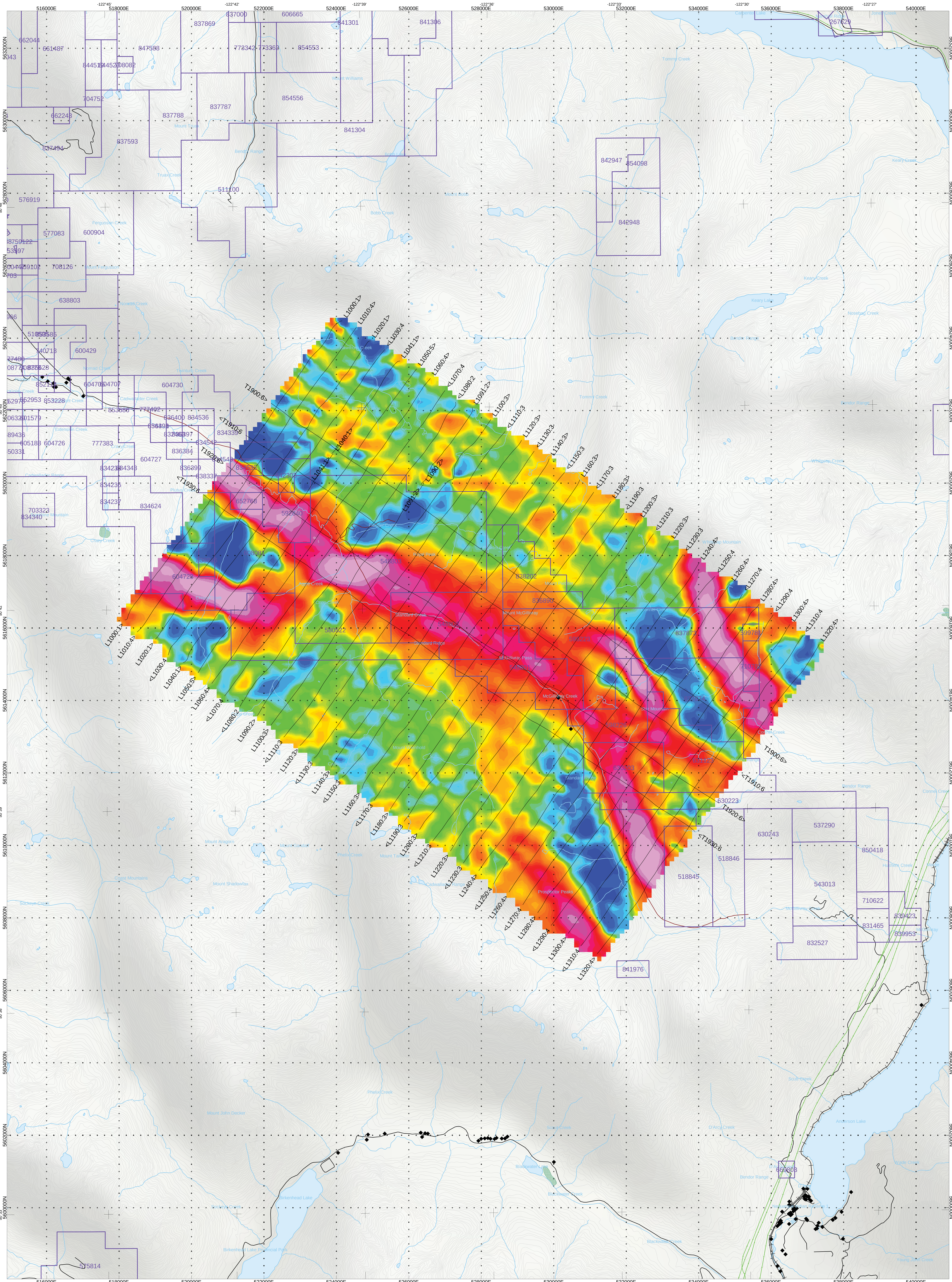
The topographic data base was derived from 1:50,000 NRC (Natural Resources Canada) NTDB data
Background shading is derived from NASA SRTM (Shuttle Radar Topographic Mission) data
Inset data derived from Geocommunities 1:250,000 Canadian National Topographic database
Mineral Dispositions are derived from the British Columbia Ministry of Energy and Mines
Geogratis (www.geogratis.ca) Geocommunities (www.geocomm.com)
Claims (http://www.empr.gov.bc.ca)

Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
3D View of Total Divergence versus SKin Depth (30 to 720 Hz)

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011



GEOTECH LTD.

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
Nominal Survey Line Direction: N 35° E / N 215° E
Nominal Survey Tie Line Spacing: 1000 Meters
Nominal Survey Tie Line Direction: N 125° E / N 305° E
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Mean Ground Air Speed: 25 metres/sec
ZTEM airborne coil: towed at a mean distance of 70 m below the helicopter
Airborne Magnetometer bird: towed at a mean distance of 55 m below the helicopter

HELICOPTER SPECIFICATIONS

Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
Coil dimensions: 3.5 metres each side
Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

Frequencies extracted: 30, 45, 90, 180, 360, 720Hz.
Sampling rate: 0.4 sec.
Rotation of the inphase part of the inline and orthogonal components (Z/Xloc and Z/Yloc)on to UTM Eastings and Northings.
Attitude correction applied, (calculated from 3 GPS recievers installed on aiborne coil).
DIV(Tilt) calculated: dXcomp/dX+dYcomp/dY for all 6 frequencies.
Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16

0.231
0.196
0.172
0.154
0.139
0.127
0.118
0.110
0.104
0.098
0.093
0.088
0.084
0.079
0.075
0.069
0.063
0.057
0.051
0.043
0.035
0.027
0.019
0.009
-0.004
-0.019
-0.036
-0.052
-0.070
-0.092
-0.116
-0.138
-0.169
-0.197
-0.232
-0.282
-0.346
-0.471

30 Hz IP DT
(1000*1/m)

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

The topographic data base was derived from 1:50,000 NRC (Natural Resources Canada) NTDB data
Background shading is derived from NASA SRTM (Shuttle Radar Topographic Mission) data
Inset data derived from Geocommunities 1:250,000 Canadian National Topographic database
Mineral Dispositions are derived from the British Columbia Ministry of Energy and Mines
Geogratis (www.geogratis.ca) Geocommunities (www.geocomm.com)
Claims (http://www.empr.gov.bc.ca)

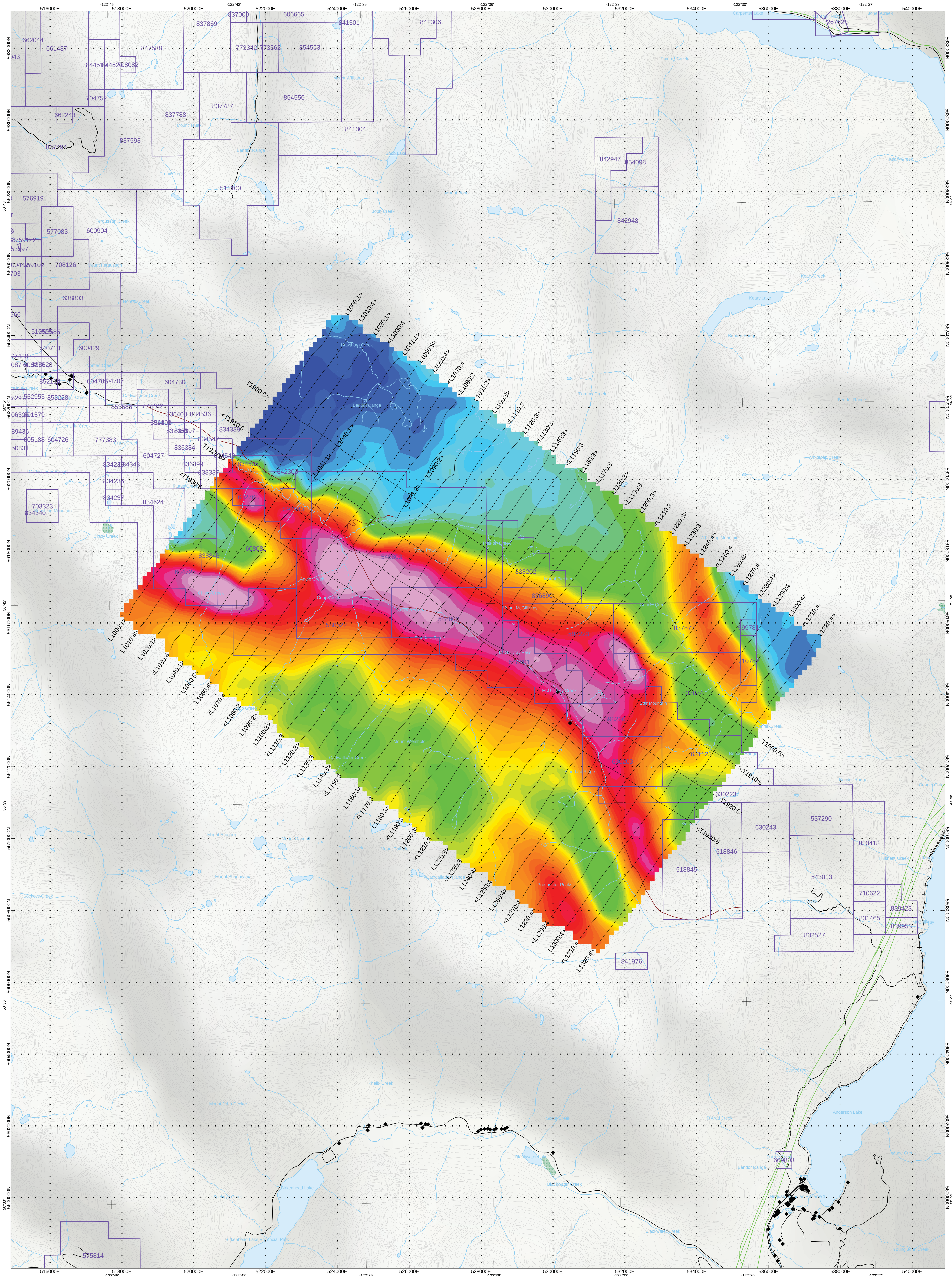
Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
30 Hz In-Phase
Total Divergence (DT) Grid

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11059



GEOTECH LTD.

Scale 1:10,000,000

(kilometers)

NAD 83/ UTM zone 10N

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
Nominal Survey Line Direction: N 35° E / N 215° E
Nominal Survey Tie Line Spacing: 1000 Meters
Nominal Survey Tie Line Direction: N 125° E / N 305° E
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Mean Ground Air Speed: 25 metres/sec
ZTEM airborne coil: towed at a mean distance of 70 m below the helicopter
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Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

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GPS Receivers Location: One on the helicopter, three on EM coil
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Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

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Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
Coil dimensions: 3.5 metres each side
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Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

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Sampling rate: 0.4 sec.
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Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16

0.298
0.266
0.246
0.226
0.209
0.192
0.174
0.157
0.139
0.123
0.108
0.094
0.080
0.066
0.054
0.042
0.032
0.023
0.015
0.008
0.002
-0.005
-0.011
-0.016
-0.021
-0.026
-0.031
-0.040
-0.054
-0.073
-0.092
-0.108
-0.126
-0.143
-0.166
-0.193
-0.216
-0.254

30 Hz Tzx IP

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500

(meters)

NAD 83/ UTM zone 10N

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Inset data derived from Geocommunities 1:250,000 Canadian National Topographic database
Mineral Dispositions are derived from the British Columbia Ministry of Energy and Mines
Geogratis (www.geogratis.ca) Geocommunities (www.geocomm.com)
Claims (http://www.empr.gov.bc.ca)

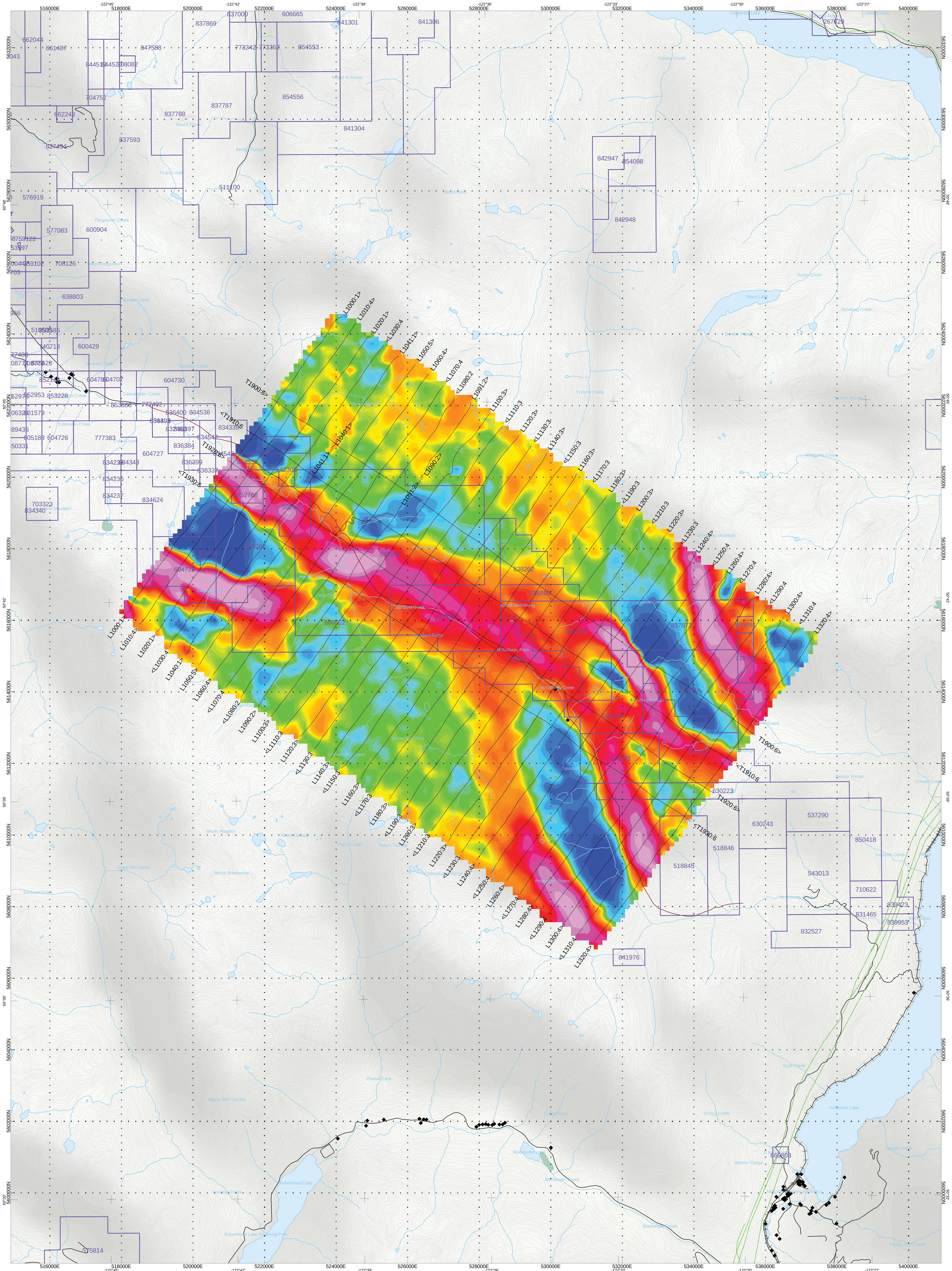
Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
30 Hz Phase-Rotated In-Phase Tzx (In-Line) Grid

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11059



GEOTECH LTD.

Scale 1:10,000,000

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
Nominal Survey Line Direction: N 35° E / N 215° E
Nominal Survey Tie Line Spacing: 1000 Meters
Nominal Survey Tie Line Direction: N 125° E / N 305° E
Helicopter Mean Terrain Clearance: 297 metres
Mean Ground Air Speed: 25 metres/sec
ZTEM airborne coil: towed at a mean distance of 70 m below the helicopter
Airborne Magnetometer bird: towed at a mean distance of 55 m below the helicopter

HELICOPTER SPECIFICATIONS

Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
Coil dimensions: 3.5 metres each side
Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

Frequencies extracted: 30, 45, 90, 180, 360, 720Hz.
Sampling rate: 0.4 sec.
Rotation of the inphase part of the inline and orthogonal components (Z/Xloc and Z/Yloc)on to UTM Eastings and Northings.
Attitude correction applied, (calculated from 3 GPS recievers installed on aiborne coil).
DIV(Tilt) calculated: dXcomp/dX+dYcomp/dY for all 6 frequencies.
Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16

0.323
0.268
0.235
0.203
0.177
0.159
0.147
0.136
0.127
0.120
0.113
0.106
0.099
0.094
0.087
0.080
0.074
0.066
0.059
0.050
0.043
0.034
0.024
0.013
-0.001
-0.020
-0.041
-0.065
-0.091
-0.123
-0.156
-0.192
-0.236
-0.278
-0.323
-0.398
-0.486
-0.632

90 Hz IP DT
(1000*1/m)

TOPOGRAPHIC LEGEND:

- Buildings
- Utility Lines
- Railways
- Roads
- Trails
- Contours
- Rivers / Streams
- Lakes / Ponds
- Wetlands
- Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

The topographic data base was derived from 1:50,000 NRC (Natural Resources Canada) NTDB data
Background shading is derived from NASA SRTM (Shuttle Radar Topographic Mission) data
Inset data derived from Geocommunities 1:250,000 Canadian National Topographic database
Mineral Dispositions are derived from the British Columbia Ministry of Energy and Mines
Geogratis (www.geogratis.ca) Geocommunities (www.geocomm.com)
Claims (http://www.empr.gov.bc.ca)

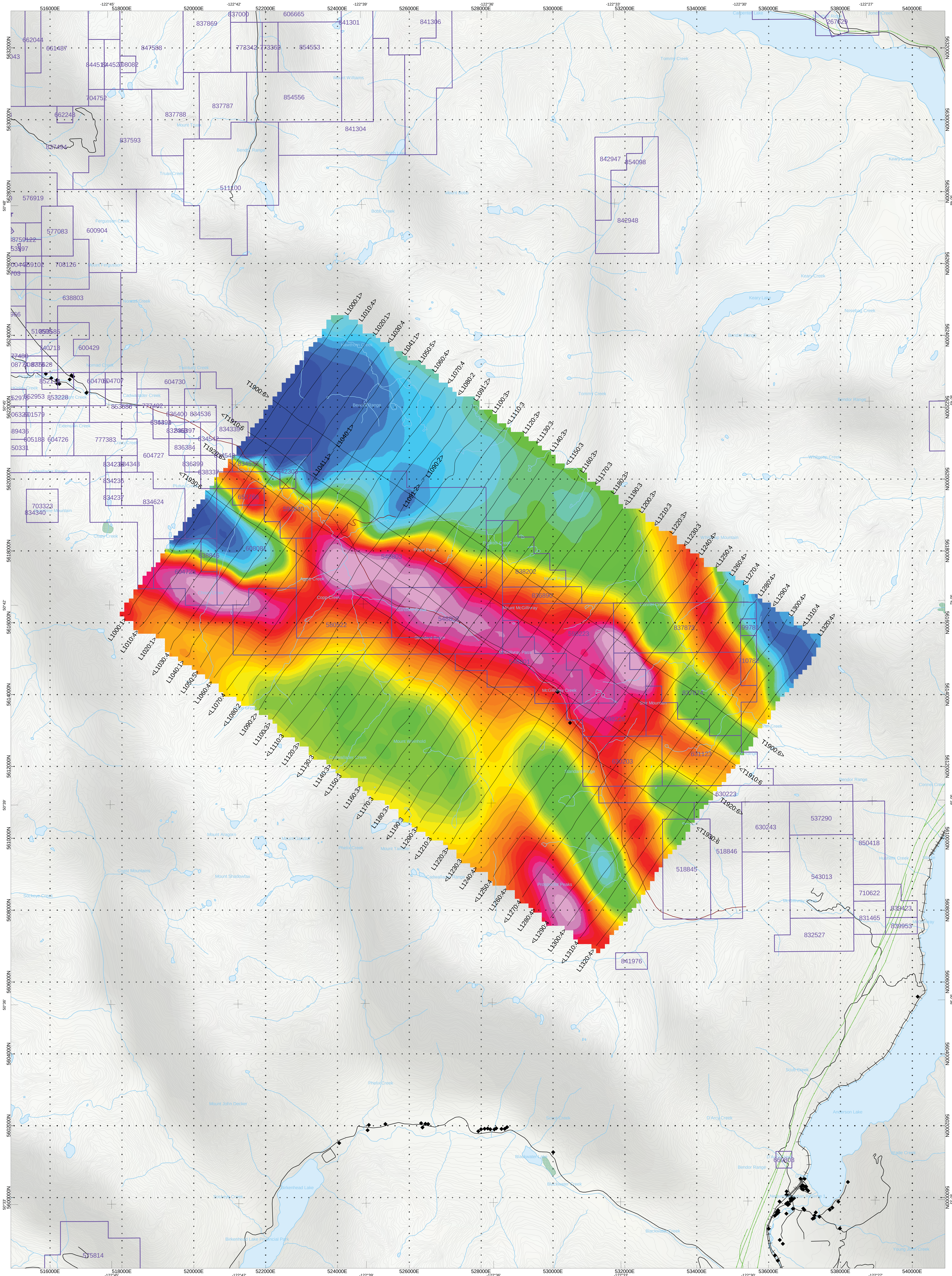
Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
90 Hz In-Phase
Total Divergence (DT) Grid

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11059



GEOTECH LTD.

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
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Airborne Magnetometer bird: towed at a mean distance of 55 m below the helicopter

HELICOPTER SPECIFICATIONS

Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

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GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
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Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

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Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16

0.373
0.316
0.287
0.266
0.234
0.204
0.180
0.159
0.141
0.123
0.106
0.088
0.071
0.055
0.041
0.027
0.013
0.001
-0.008
-0.018
-0.028
-0.036
-0.043
-0.048
-0.053
-0.056
-0.065
-0.079
-0.094
-0.107
-0.116
-0.132
-0.152
-0.176
-0.193
-0.215
-0.238
-0.258

90 Hz Tzx IP

TOPOGRAPHIC LEGEND:

- Buildings
- Utility Lines
- Railways
- Roads
- Trails
- Contours
- Rivers / Streams
- Lakes / Ponds
- Wetlands
- Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500

(meters)

NAD 83/ UTM zone 10N

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Claims (http://www.empr.gov.bc.ca)

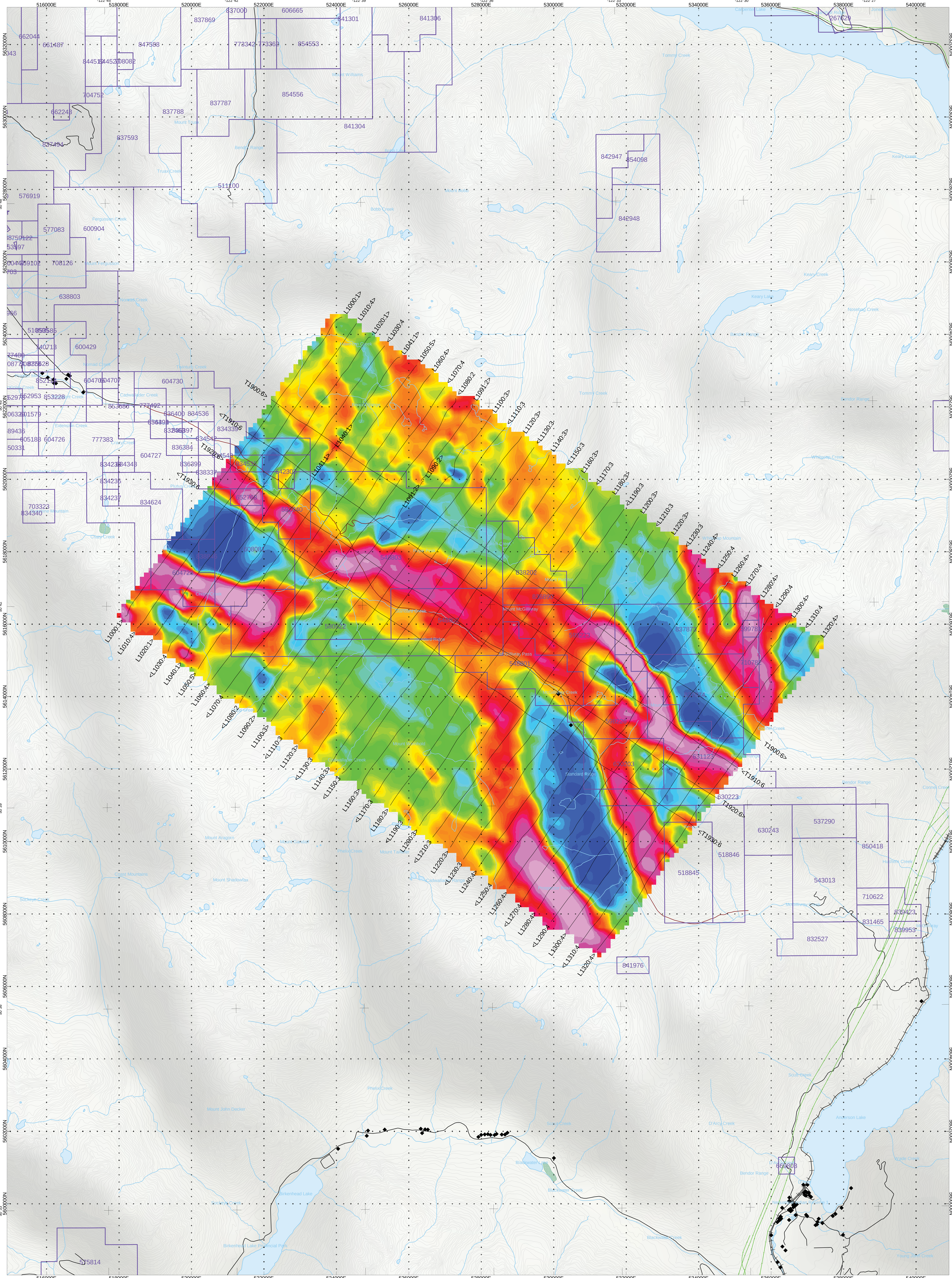
Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
90 Hz Phase-Rotated In-Phase Tzx (In-Line) Grid

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11059



GEOTECH LTD.

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
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Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
Coil dimensions: 3.5 metres each side
Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

Frequencies extracted: 30, 45, 90, 180, 360, 720Hz.
Sampling rate: 0.4 sec.
Rotation of the inphase part of the inline and orthogonal components (Z/Xloc and Z/Yloc)on to UTM Eastings and Northings.
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MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16

0.416
0.353
0.302
0.262
0.229
0.204
0.186
0.171
0.157
0.146
0.135
0.123
0.112
0.100
0.088
0.075
0.064
0.052
0.040
0.028
0.017
0.006
-0.004
-0.016
-0.033
-0.050
-0.071
-0.092
-0.119
-0.146
-0.179
-0.215
-0.248
-0.293
-0.358
-0.433
-0.525
-0.709

360 Hz IP DT
(1000*1/m)

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

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Claims (http://www.empr.gov.bc.ca)

Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
360 Hz In-Phase
Total Divergence (DT) Grid

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
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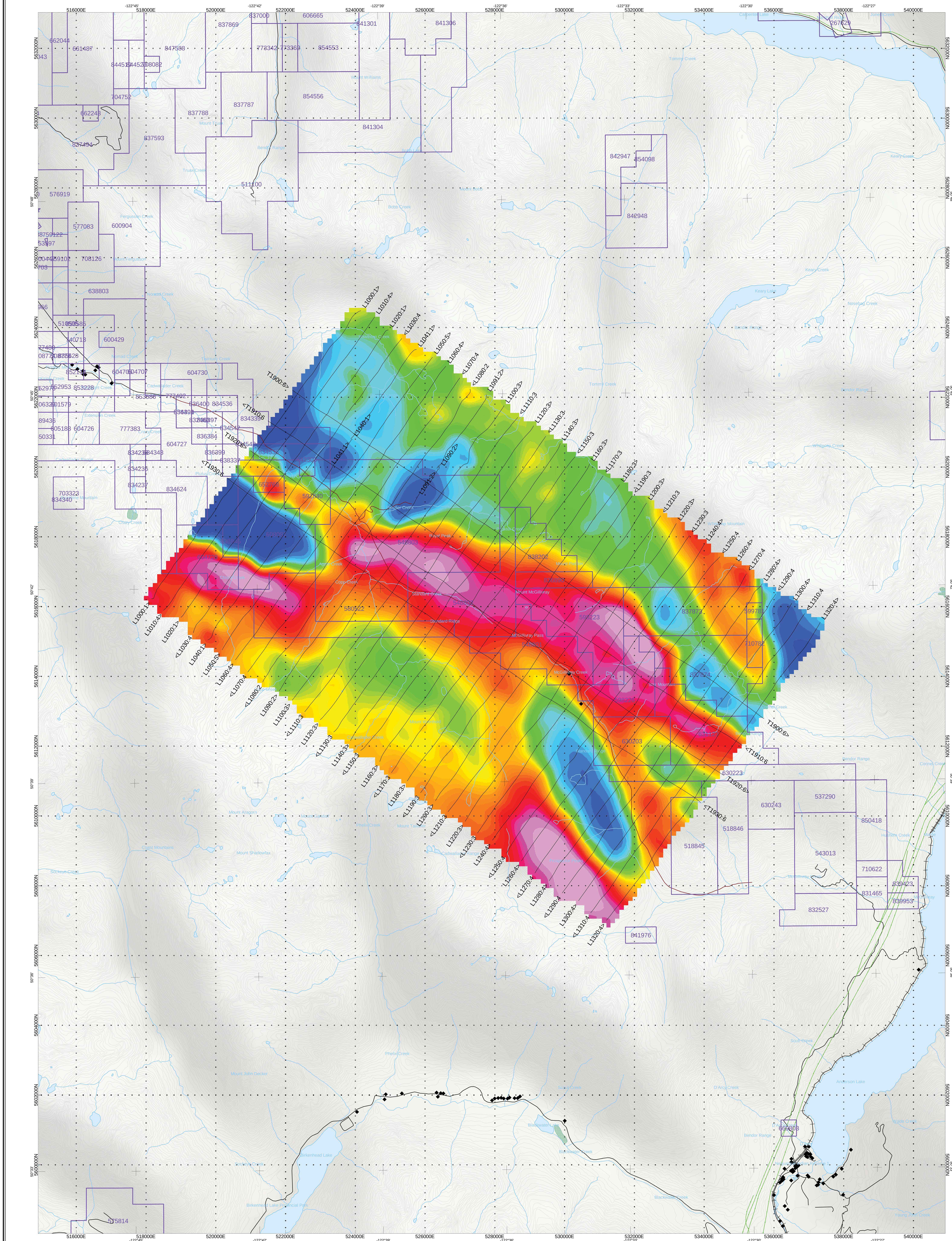
www.geotech.ca

July, 2011

Geotech Project # 11059



GEOTECH LTD.

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
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Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

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GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
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Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

Frequencies extracted: 30, 45, 90, 180, 360, 720Hz.
Sampling rate: 0.4 sec.
Rotation of the inphase part of the inline and orthogonal components (Z/Xloc and Z/Yloc)on to UTM Eastings and Northings.
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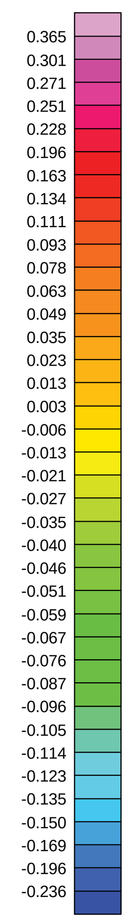
DIV(Tilt) calculated: dXcomp/dX+dYcomp/dY for all 6 frequencies.
Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16



360 Hz Tzx IP

TOPOGRAPHIC LEGEND:

- Buildings
- Utility Lines
- Railways
- Roads
- Trails
- Contours
- Rivers / Streams
- Lakes / Ponds
- Wetlands
- Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

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Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

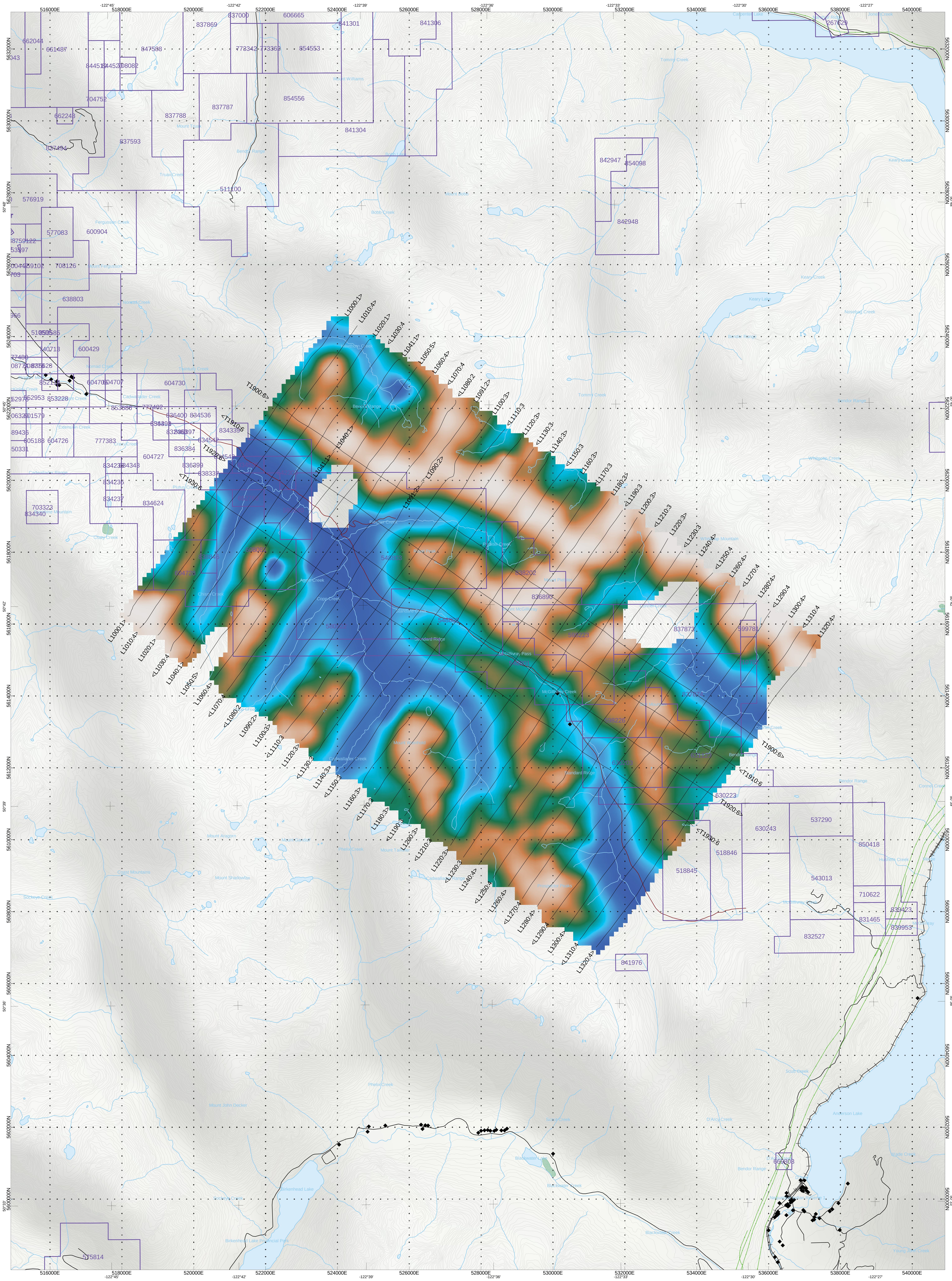
Geotech ZTEM System
360 Hz Phase-Rotated
In-Phase Tzx (In-Line) Grid

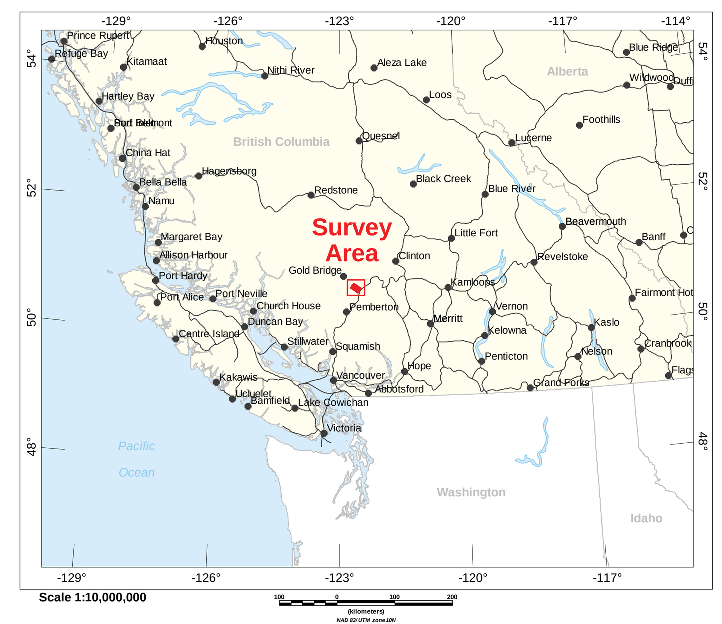
Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11069

GEOTECH LTD.





SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
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Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
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Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

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Two orthogonal square coils
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Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

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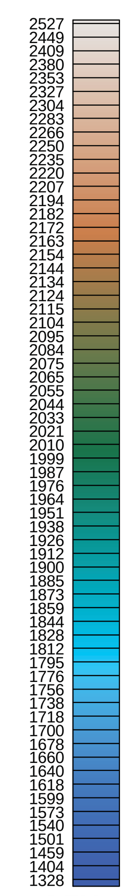

DEM
(m)

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

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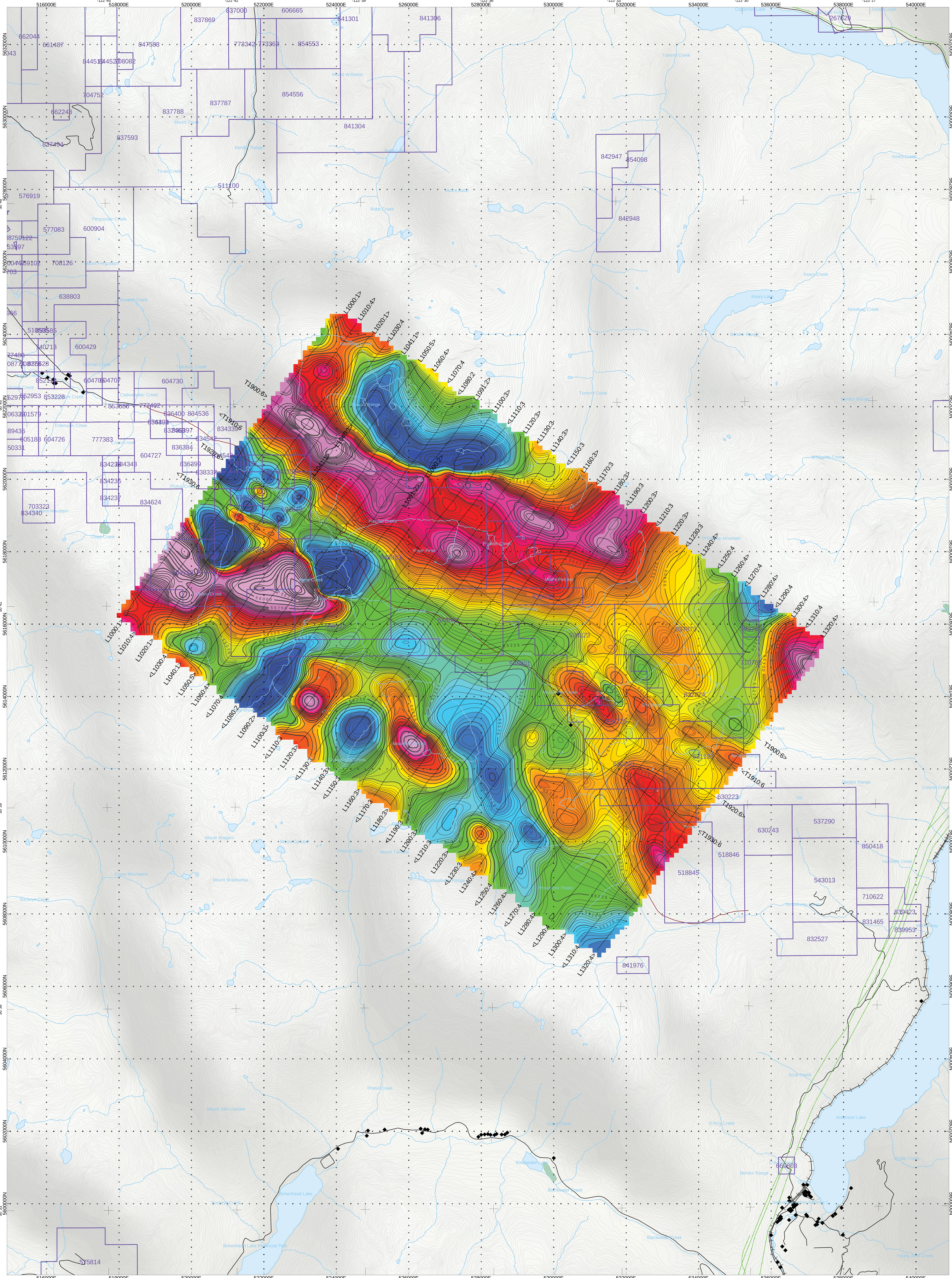
Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
Digital Elevation Model (DEM)

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11099



GEOTECH LTD.

Scale 1:10,000,000

100 0 100 200 (kilometers)

NAD 83/ UTM zone 10N

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
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MAGNETIC BASE STATION

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Attitude correction applied, (calculated from 3 GPS recievers installed on aiborne coil).
DIV(Tilt) calculated: dXcomp/dX+dYcomp/dY for all 6 frequencies.
Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16

TMI Contour Intervals:
5 nT
25 nT
125 nT

55860
55680
55620
55565
55530
55500
55470
55440
55405
55380
55360
55345
55330
55320
55310
55305
55300
55290
55285
55280
55275
55265
55260
55255
55250
55240
55230
55225
55215
55210
55200
55190
55185
55175
55160
55145
55130
55090

TMI
(nT)

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500

(meters)

NAD 83/ UTM zone 10N

The topographic data base was derived from 1:50,000 NRC (Natural Resources Canada) NTDB data
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Claims (http://www.empr.gov.bc.ca)

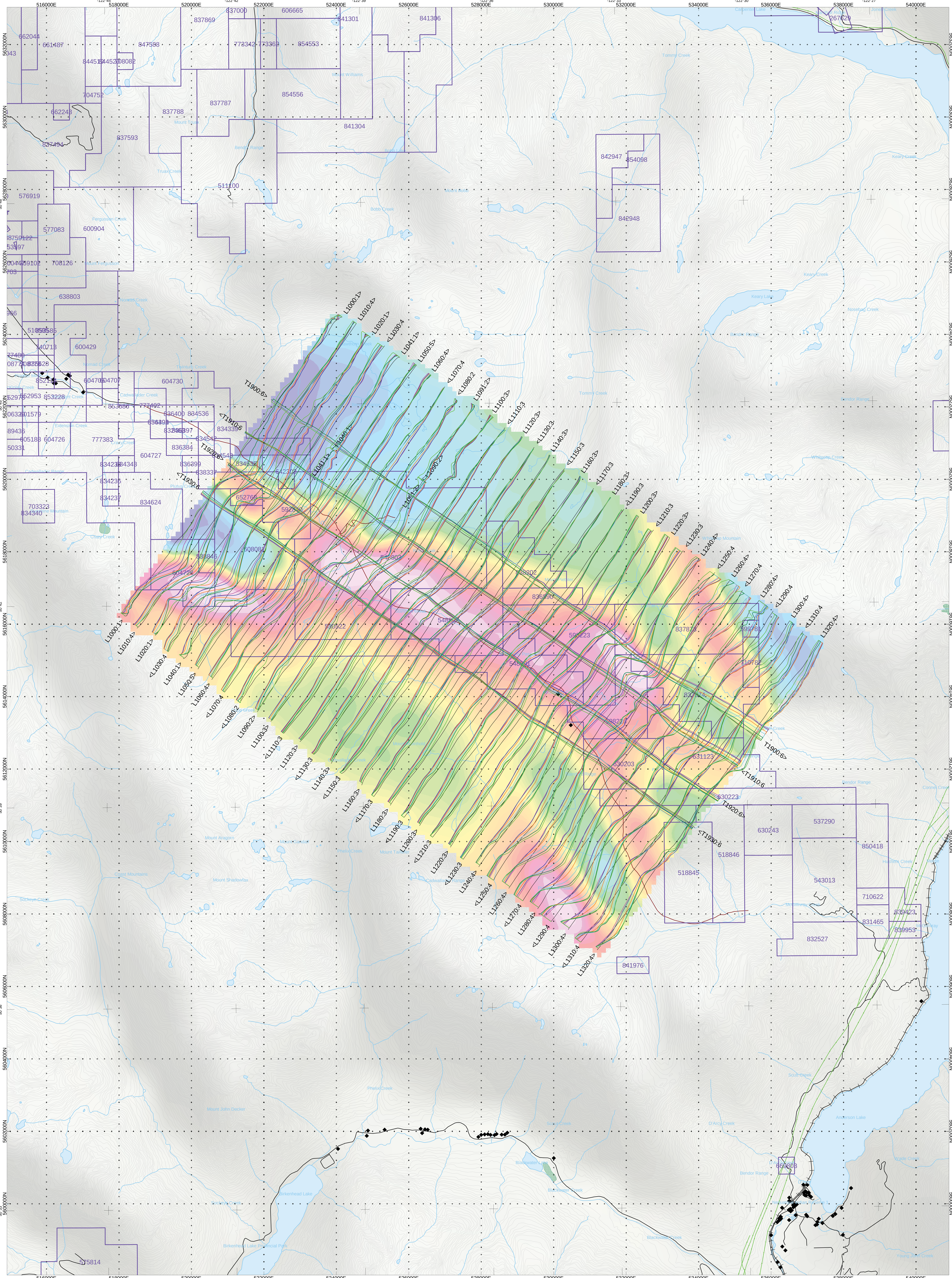
Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
Total Magnetic Intensity (TMI)

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11059



GEOTECH LTD.

Scale 1:10,000,000

(kilometers)

NAD 83/ UTM zone 10N

SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
Nominal Survey Line Direction: N 35° E / N 215° E
Nominal Survey Tie Line Spacing: 1000 Meters
Nominal Survey Tie Line Direction: N 125° E / N 305° E
Helicopter Mean Terrain Clearance: 297 metres
Mean Ground Air Speed: 25 metres/sec
ZTEM airborne coil: towed at a mean distance of 70 m below the helicopter
Airborne Magnetometer bird: towed at a mean distance of 55 m below the helicopter

HELICOPTER SPECIFICATIONS

Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
Coil dimensions: 3.5 metres each side
Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

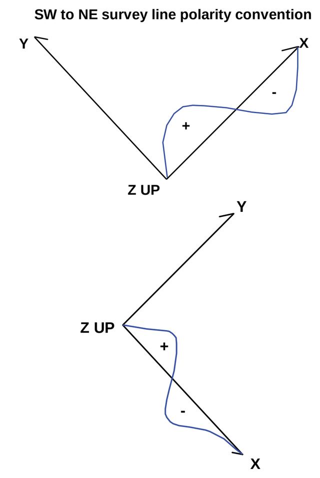
ZTEM:

Frequencies extracted: 30, 45, 90, 180, 360, 720Hz.
Sampling rate: 0.4 sec.
Rotation of the inphase part of the inline and orthogonal components (Z/Xloc and Z/Yloc)on to UTM Eastings and Northings.
Attitude correction applied, (calculated from 3 GPS recievers installed on aiborne coil).
DIV(Tilt) calculated: dXcomp/dX+dYcomp/dY for all 6 frequencies.
Phase Rotated Grids (90 deg) calculated from each individual X and Y component grids, for each individual frequency.

MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16

SW to NE survey line polarity convention



NW to SE tie line polarity convention

In-Phase Frequencies
0.05 units per mm
Profile Base = 0

30 Hz	
45 Hz	
90 Hz	
180 Hz	
360 Hz	
720 Hz	

0.373
0.316
0.287
0.266
0.234
0.204
0.180
0.159
0.141
0.123
0.106
0.088
0.071
0.055
0.041
0.027
0.013
0.001
-0.008
-0.018
-0.028
-0.036
-0.043
-0.048
-0.053
-0.056
-0.065
-0.079
-0.094
-0.107
-0.116
-0.132
-0.152
-0.176
-0.193
-0.215
-0.238
-0.258

90 Hz Tzx IP

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500

(meters)

NAD 83/ UTM zone 10N

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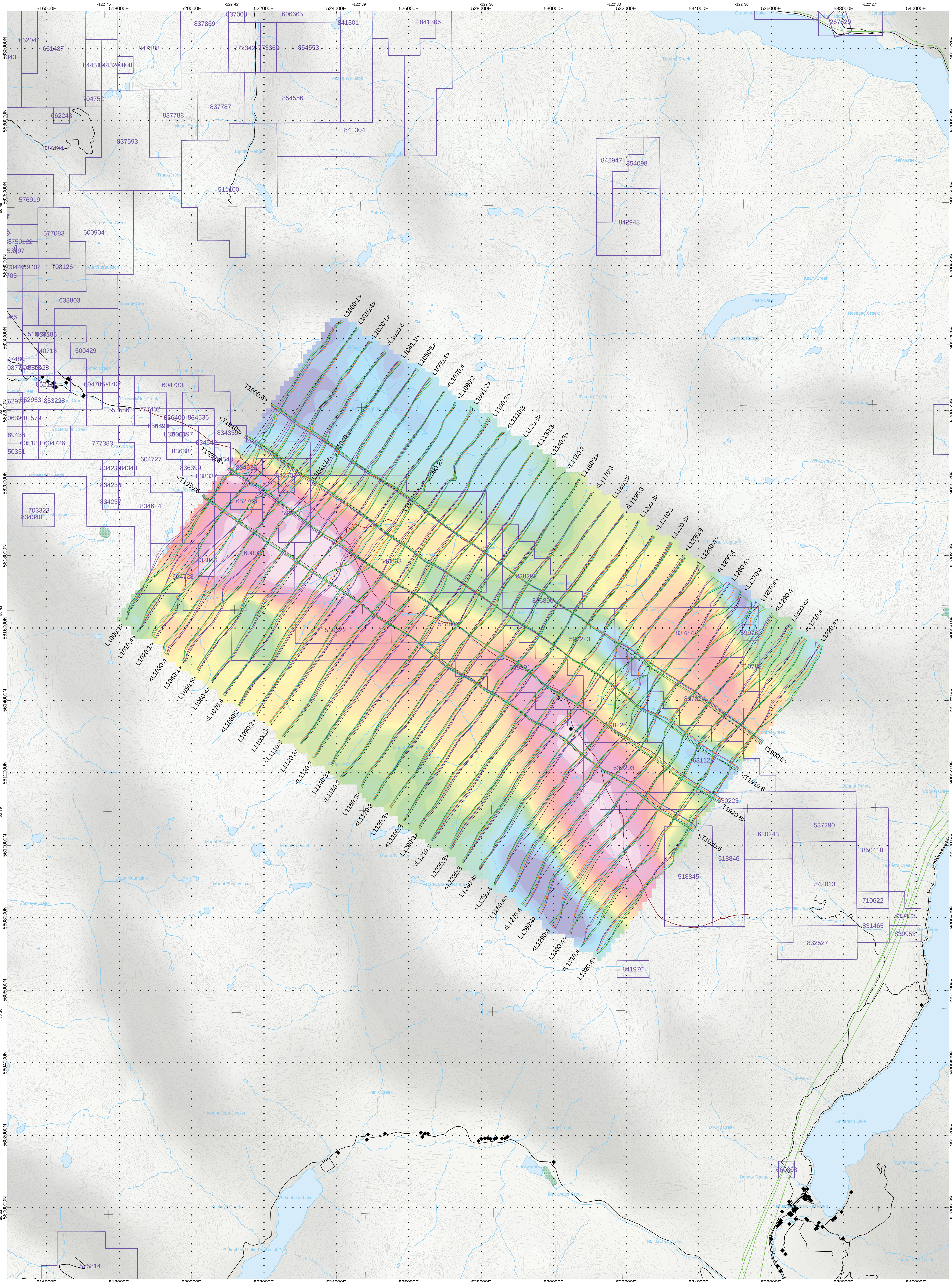
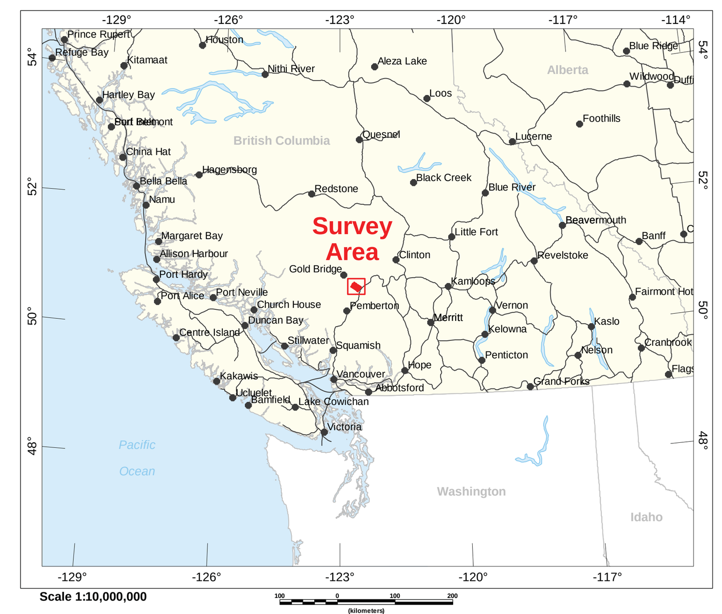
Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

Geotech ZTEM System
Tzx (In-Line) In-Phase Profiles over a 90 Hz Phase-Rotated In-Phase Tzx (In-Line) Grid

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011





SURVEY SPECIFICATIONS:

Survey Flying Date: May 22nd to May 30th, 2011
Survey Operations Base: Gold Bridge, British Columbia
Nominal Survey Line Spacing: 500 Meters
Nominal Survey Line Direction: N 35° E / N 215° E
Nominal Survey Tie Line Spacing: 1000 Meters
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Mean Ground Air Speed: 25 metres/sec
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Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
Radar Altimeter: Terra TRA 3000/TRI 40
Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

EM BASE STATION

Two orthogonal square coils
Coil dimensions: 3.5 metres each side
Coil orientation: Horizontal Dipole
Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

Frequencies extracted: 30, 45, 90, 180, 360, 720Hz.
Sampling rate: 0.4 sec.
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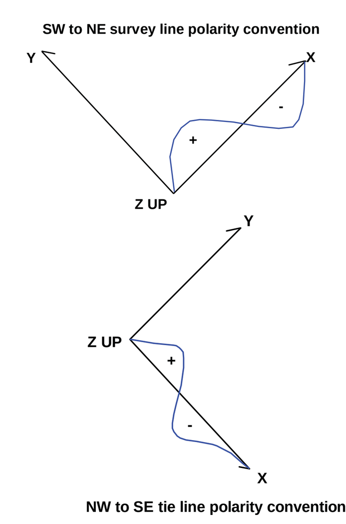
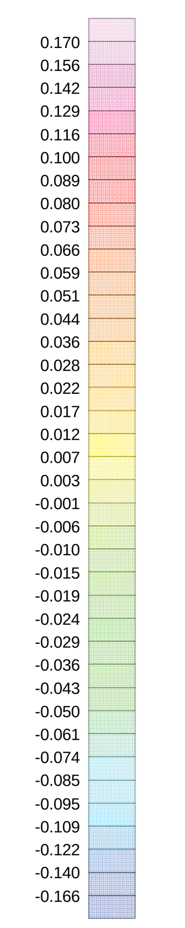
MAP PROJECTION

Datum: NAD 83
Projection: Universal Transverse Mercator
Central Meridian: 123°W (Zone 10N)
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16





90 Hz Tzx QD

Quadrature Frequencies
0.05 units per mm
Profile Base = 0

30 Hz
45 Hz
90 Hz
180 Hz
360 Hz
720 Hz

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

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Claims (http://www.empr.gov.bc.ca)

Worthington Resources Ltd.
Royalle Property
Gold Bridge, British Columbia

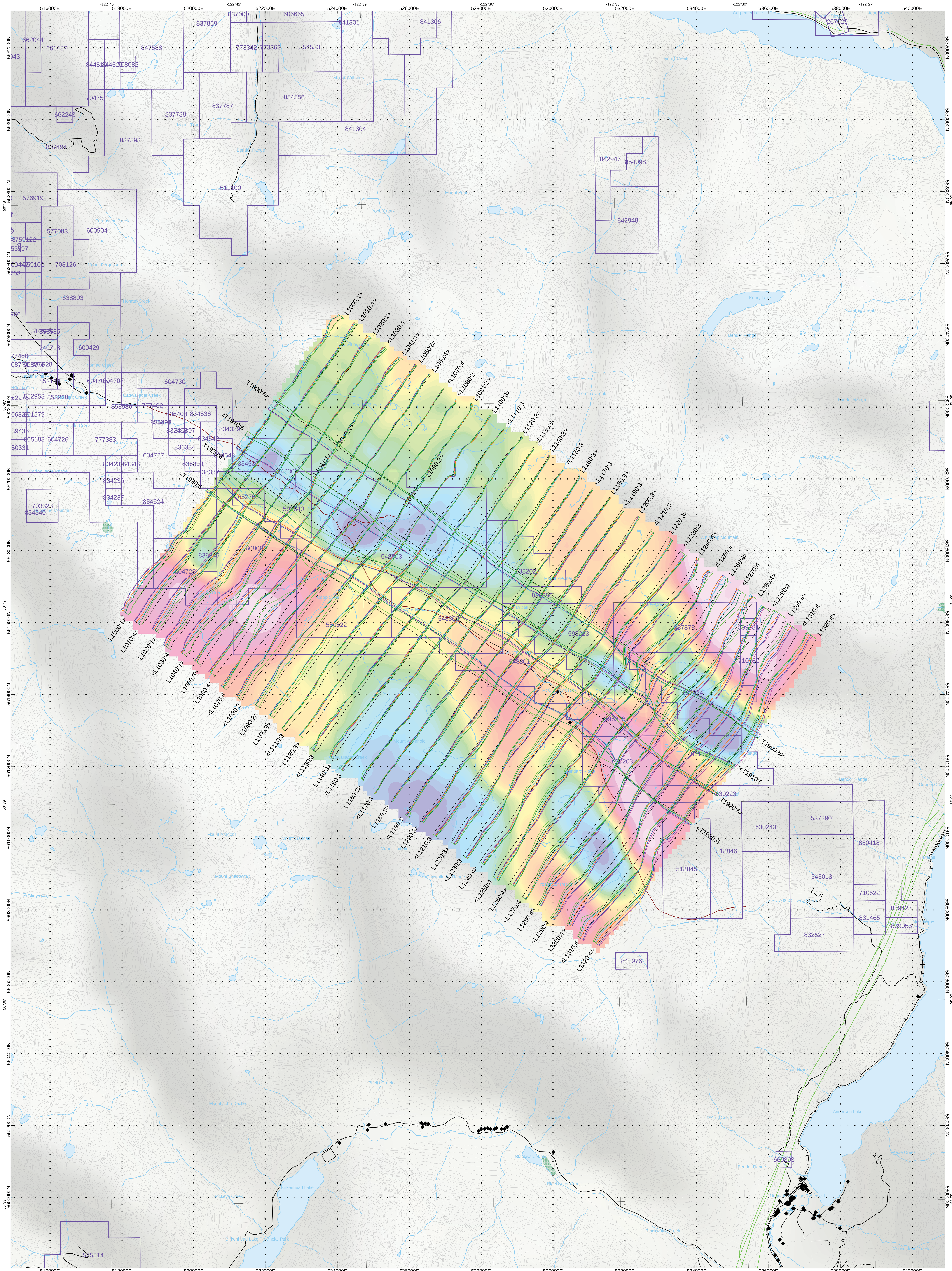
Geotech ZTEM System
Tzx (In-Line) Quadrature Profiles
over a 90 Hz Phase-Rotated
Quadrature Tzx (In-Line) Grid

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
www.geotech.ca

July, 2011

Geotech Project # 11068

GEOTECH LTD.



SURVEY SPECIFICATIONS:

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Survey Operations Base: Gold Bridge, British Columbia
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Mean Ground Air Speed: 25 metres/sec
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Helicopter Type: Aerospatiale A-Star 350 B3 (C-GABH)

AIRBORNE INSTRUMENTATION

Survey Type: Helicopter Z-Axis Tipper Electromagnetic (ZTEM), Magnetic towed Bird
GPS Receivers (4): NovAtel CDGPS enabled Propak V3-RT20
GPS Receivers Location: One on the helicopter, three on EM coil
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Navigation: GEONAV-3

AIRBORNE ELECTROMAGNETIC SYSTEM

Electromagnetic System: Geotech Z-Axis Tipper (ZTEM)
Coil dimensions: 7.4 metres diameter
Coil orientation: Vertical Dipole
Digitizing rate: 2000Hz

AIRBORNE MAGNETOMETER

Magnetometer: GEOMETRICS
Magnetometer Sensitivity: +/- 0.02 nT
Sampling Rate: 0.2 Hz

GROUND INSTRUMENTATION

MAGNETIC BASE STATION

Magnetometer: GEOMETRICS
Base Station Location: near a lake by the crew's lodge (50°52.5018' N, 122°51.6707' W)

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Two orthogonal square coils
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Base Station Location: near a river in a valley (50.700027° N, 122.857704° W)
Azimuth : AzA = N 56° E AzB = N 146° E

PROCESSING SUMMARY

MAGNETICS:

Diurnal Subtraction, microlevelling

ZTEM:

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Rotation of the inphase part of the inline and orthogonal components (Z/Xloc and Z/Yloc)on to UTM Eastings and Northings.
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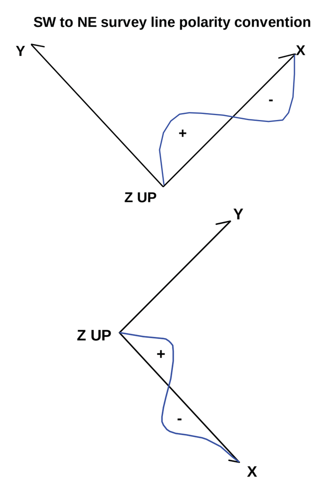
Central Scale Factor: 0.9996
False Easting/Northing: 500,000m/0m
Major Axis: 6378137.0
Eccentricity: 0.08181919084
NTS: 092J09, 092J10, 092J15 & 092J16



In-Phase Frequencies
0.05 units per mm
Profile Base = 0

	30 Hz
	45 Hz
	90 Hz
	180 Hz
	360 Hz
	720 Hz

0.249
0.198
0.170
0.147
0.126
0.107
0.091
0.076
0.063
0.051
0.043
0.036
0.030
0.025
0.019
0.015
0.011
0.007
0.003
-0.001
-0.005
-0.010
-0.014
-0.017
-0.021
-0.024
-0.028
-0.032
-0.036
-0.040
-0.045
-0.051
-0.058
-0.065
-0.071
-0.080
-0.088
-0.098

90 Hz Tzy IP

TOPOGRAPHIC LEGEND:

- Buildings
- Utility Lines
- Railways
- Roads
- Trails
- Contours
- Rivers / Streams
- Lakes / Ponds
- Wetlands
- Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

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Worthington Resources Ltd.
Royalle Property
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Tzy (Cross-Line) In-Phase Profiles
over a 90 Hz Phase-Rotated
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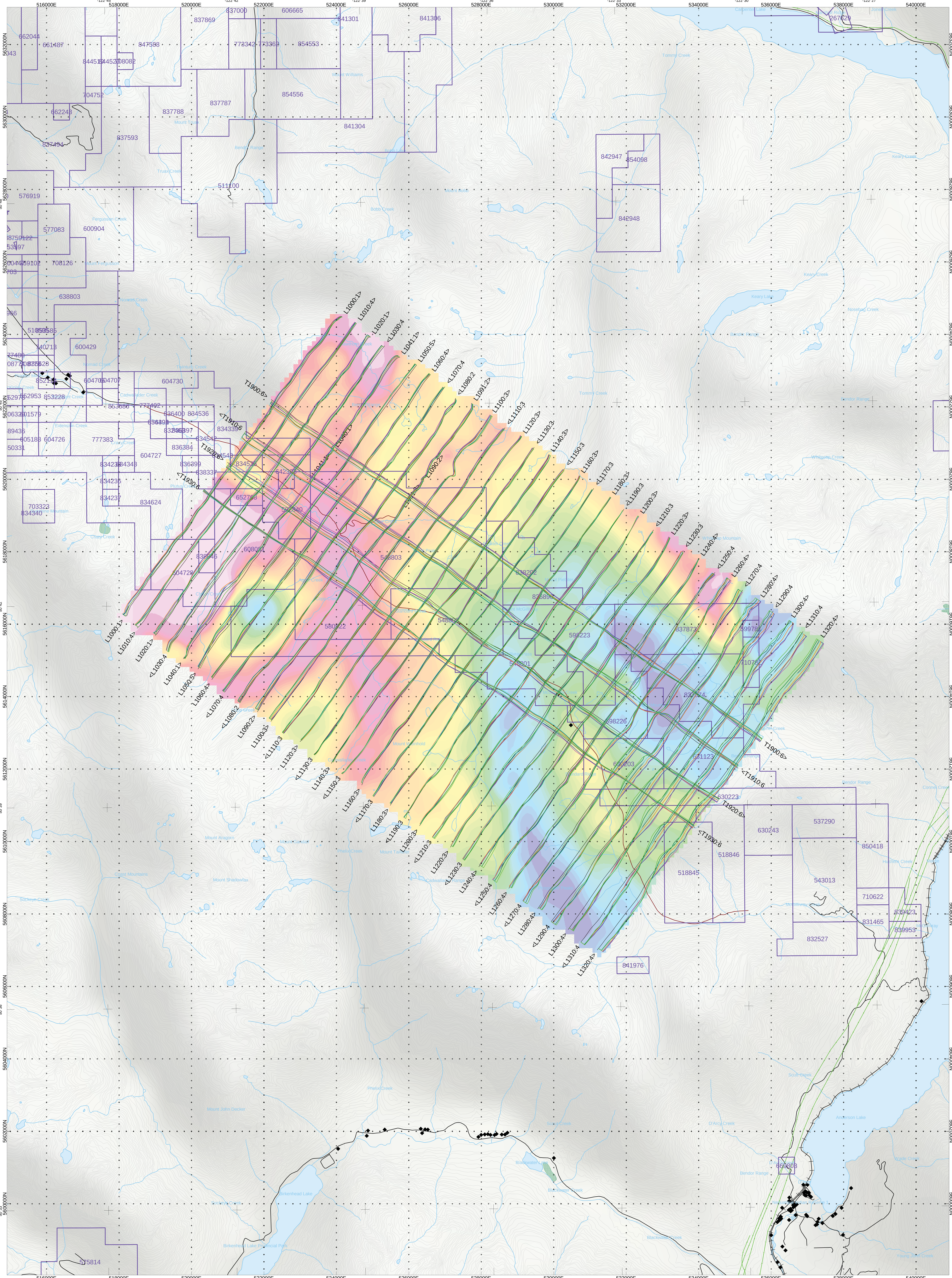
July, 2011

Geotech Project # 11059



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Major Axis: 6378137.0
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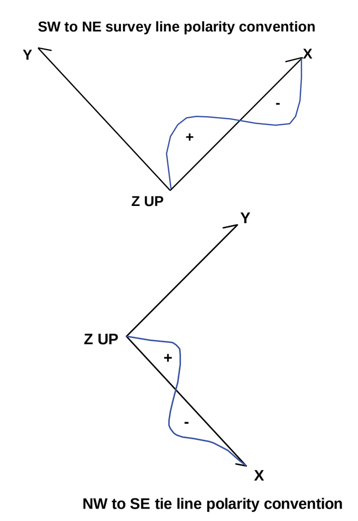
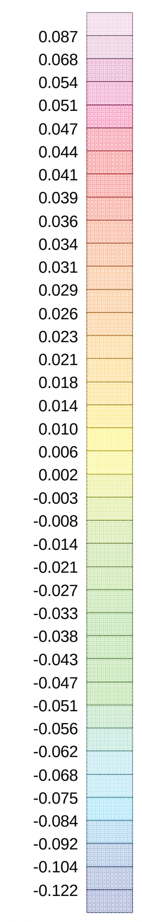
NTS: 092J09, 092J10, 092J15 & 092J16





90 Hz Tzy QD

Quadrature Frequencies
0.05 units per mm
Profile Base = 0

30 Hz
45 Hz
90 Hz
180 Hz
360 Hz
720 Hz

TOPOGRAPHIC LEGEND:

Buildings
Utility Lines
Railways
Roads
Trails
Contours
Rivers / Streams
Lakes / Ponds
Wetlands
Mining Claims

Scale 1:50000

500 0 500 1000 1500 2000 2500
(meters)
NAD 83/ UTM zone 10N

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