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BC Geological Survey

Assessment Report
Title Page and Summary

TYPE OF REPORT [type of survey(s)]: Geophysical report for the Goatfell Property

TOTAL COST: $103,058.80

AUTHOR(S): Christopher S. Gallagher

SIGNATURE(S): Chris Gallagher Digitally signed by Chris Gallagher DN: cn=Chris Gallagher, o=TerraLogic Exploration Inc., ou, email=csg@terralogicexploration.com, c=CA Date: 2012.02.28 11:11:35 -07'00'

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S): None

YEAR OF WORK: 2011

STATEMENT OF WORK - CASH PAYMENTS EVENT NUMBER(S)/DATE(S): 5107287

PROPERTY NAME: Goatfell

CLAIM NAME(S) (on which the work was done): 835429, 835430, 835431, 835432, 835433

COMMODITIES SOUGHT: Pb, Zn, Ag, Au

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN: 082FSE107, 082FSE998

MINING DIVISION: Fort Steele Mining Division

NTS/BCGS: 082F01

LATITUDE: 49 ° 05 ' 00 " **LONGITUDE:** 116 ° 12 ' 30 " **(at centre of work)**

OWNER(S):

1) Eagle Plains Resources Ltd.

2)

MAILING ADDRESS:

Suite 200 44-12th Ave South, Cranbrook, BC, V1A2R7

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

1) 101191710 Saskatchewan Ltd.

2)

MAILING ADDRESS:

602-224 4th Avenue South, Saskatoon, SK, S7K 5M5

PROPERTY GEOLOGY KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralization, size and attitude):

Middle Proterozoic, Purcell Supergroup, Middle Aldridge Formation, Moyie Intrusions, Creston Formation, Moyie Fault, Spider Fault, Sullivan Time, Kid Marker, SEDEX, tourmalinite alteration, sphalerite, galena, arsenopyrite,

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS: 24223, 24393, 14773, 16790, 18633, 19304, 21939, 23866, 23961

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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	Fugro AGG Survey + Geotech Mag + EM	835429, 835430, 835431, 835432, 83	$103,058.80
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:	$103,058.80

GEOPHYSICAL REPORT
on the
GOATFELL PROPERTY

Fort Steele Mining Division, Southeastern British Columbia

N.T.S. 82F01

Latitude 49°05' N, Longitude 116° 12' W

Prepared for

EAGLE PLAINS RESOURCES LTD.
Suite 200, 44-12th Ave. S.
Cranbrook, B.C. V1C 2R7

and

101191710 Saskatchewan Ltd.
602-224 4th Avenue South
Saskatoon, SK
S7K 5M5

by

Chris S. Gallagher, M. Sc.
TerraLogic Exploration Inc.
Suite 200, 44 12th Ave. South
Cranbrook, B.C. V1C 2R7

February 22nd, 2012

Summary

The Goatfell property consists of one contiguous claim block of seventeen claims, covering approximately 7680 hectares in a north-south oriented block parallel with the favorable stratigraphy and lying between Highway 3 and the US Border. . The property is owned 100% by Eagle Plains Resources with no underlying royalties or encumbrances. 101191710 Saskatchewan Ltd. may earn an undivided 60% interest in Eagle Plains' Goatfell Property by completing exploration expenditures of $3,000,000 making cash payments of $250,000 and issuance of 1,000,000 common shares to EPL over a four year period. The property has no underlying royalties or encumbrances.

The claims are well-situated with respect to infrastructure, with a high-pressure gas pipeline, high-voltage hydroelectric line, railway and major highway all located within or near property boundaries.

A $100,000 airborne geophysical survey consisting of 113 line-km of VTEM and 218 line-km of airborne gravity has recently been completed as part of a large survey area over the Purcell sedimentary basin with the goal of searching for geophysical signatures of structures associated with sedimentary exhalative "Sullivan" type deposits.

The property is located approximately 50 kilometers west of Cranbrook, near Yahk B.C. BC and has good access via a network of logging roads from Highway 3 between Creston and Cranbrook.

The Goatfell occurrence of scattered zinc-lead mineralization associated with tourmaline and albite alteration, is located along the CPR railway about 1.5km west of Carroll Creek. This occurrence includes an extensive area of tourmalinite float, 2.5 kms to the south of the Goatfell tourmalinite body which contains galena and sphalerite in an intensely brecciated tourmalinized matrix.

The occurrence lies within the Middle Proterozoic Purcell Supergroup, a thick succession of siliciclastic and lesser carbonate rocks. This sedimentary succession contains the Sullivan deposit, one of the world's largest massive sulphide sedimentary-exhalitive lead-zinc deposits which lies approximately 70 kms to the north. Stratigraphically, this deposit is hosted by the Aldridge Formation, at the Lower Aldridge/Middle Aldridge contact.

Four diamond-drill holes in the footwall of the Goatfell tourmalinite in 1988-89 were focused on testing the Sullivan time horizon (the projected Lower-Middle Aldridge contact). Minor tourmalinite and fracture controlled sphalerite and galena was intersected in these holes. No drilling has been conducted in the hanging wall of the Goatfell tourmalinite. In 1995, Inmet Mining Corporation conducted an EM geophysical survey and in 1996, White Knight Resources drilled 6 holes, totaling 2016 meters.

Some of the drillholes intersected tourmalinite and fracture-controlled lead and zinc. Following the 1996 drilling program, geologists on the project recommended additional drilling, though this work was never carried out.

The airborne geophysical work is part of a major (4,000 line-km) airborne geophysical survey being carried out in the region by Eagle Plains and various partners as announced on September 9th, 2011. The airborne geophysical survey is part of an ongoing, systematic exploration approach being carried out by Eagle Plains and its partners within rocks of the Belt-Purcell Supergroup for over a decade. The Belt-Purcell Supergroup is host to the world-class Sullivan Deposit.

In addition to the sedimentary exhalative target, increased activity in the area was precipitated by the discovery in late 2010 of gold-rich base-metal mineralization on the Iron Range project, associated with a major north-trending fault zone, by partners Eagle Plains and Providence Resources Corp.

The Goatfell property has many features in common with other mineralized zones and deposits in the Sullivan and Creston corridor areas; namely:

- A substantially thickened Middle Aldridge section.
- Presence of a lead-zinc soil geochemical response within the proposed graben at precisely the same stratigraphic level below the same "Moyie stratigraphic marker" that is associated with sedex mineralization at the Kid-Star property.
- Presence of substantial areas of tourmalinite alteration in "pipes" that cross-cut the favorable stratigraphy.
- The presence of typical slump and channel features representing thickening and disruption of strata adjacent to a graben or half-graben fault which may control deposition in a "third-order" sub-basin.
- Presence of a mineralized tourmalinite chaotic breccia of the type only known previously at the Sullivan deposit.
- Presence of a large area of "footwall" style quartz-chlorite-sericite-pyrite alteration and quartz veins and stockworks containing galena and sphalerite.

The geological evidence from exploration programs on the Goatfell property is permissive for sedex deposits within the Middle Aldridge or Lower Aldridge units. The drilling of four exploration holes by Chevron Minerals Ltd. and partners and eight additional drillholes later has not disproven the original theory that sedex mineralization could occur at the Sullivan Time Horizon within the property, as this unit has not yet been intersected in the drilling done to date.

A mineralizing event has been documented in the Middle Aldridge Formation on the adjacent Kid-Star property, where a sedex Pb-Zn-Ag deposit has been discovered. Strong geologic evidence suggests that this unit may be a more favorable and economically-attractive host. Recent work points to the onset of tectonic instability in the Goatfell area in the Creston structural corridor, occurring at "Kid" time, slightly later than the Sullivan time, and 2,400 feet above the level of the Sullivan deposit in the Sullivan Corridor.

Respectfully Submitted

February 22nd, 2012

Christopher S. Gallagher, M. Sc.

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Location And Access

The Goatfell property is located approximately 50 km southwest of Cranbrook, and 10 kilometers north-west of the town of Yahk (Figure 1). Access is via the Crowsnest Highway (Highway 3), which crosses the north part of the property, and a number of forestry and private roads. Road conditions generally allow access to the property by 2-wheel drive vehicle during the summer field season. The highway corridor also includes two natural gas pipelines and the CP railway branch line between Creston and Cranbrook.

Cranbrook is a major population center which provides supplies and services; the town is serviced by several daily air flights from Vancouver and Calgary.

Property Tenure

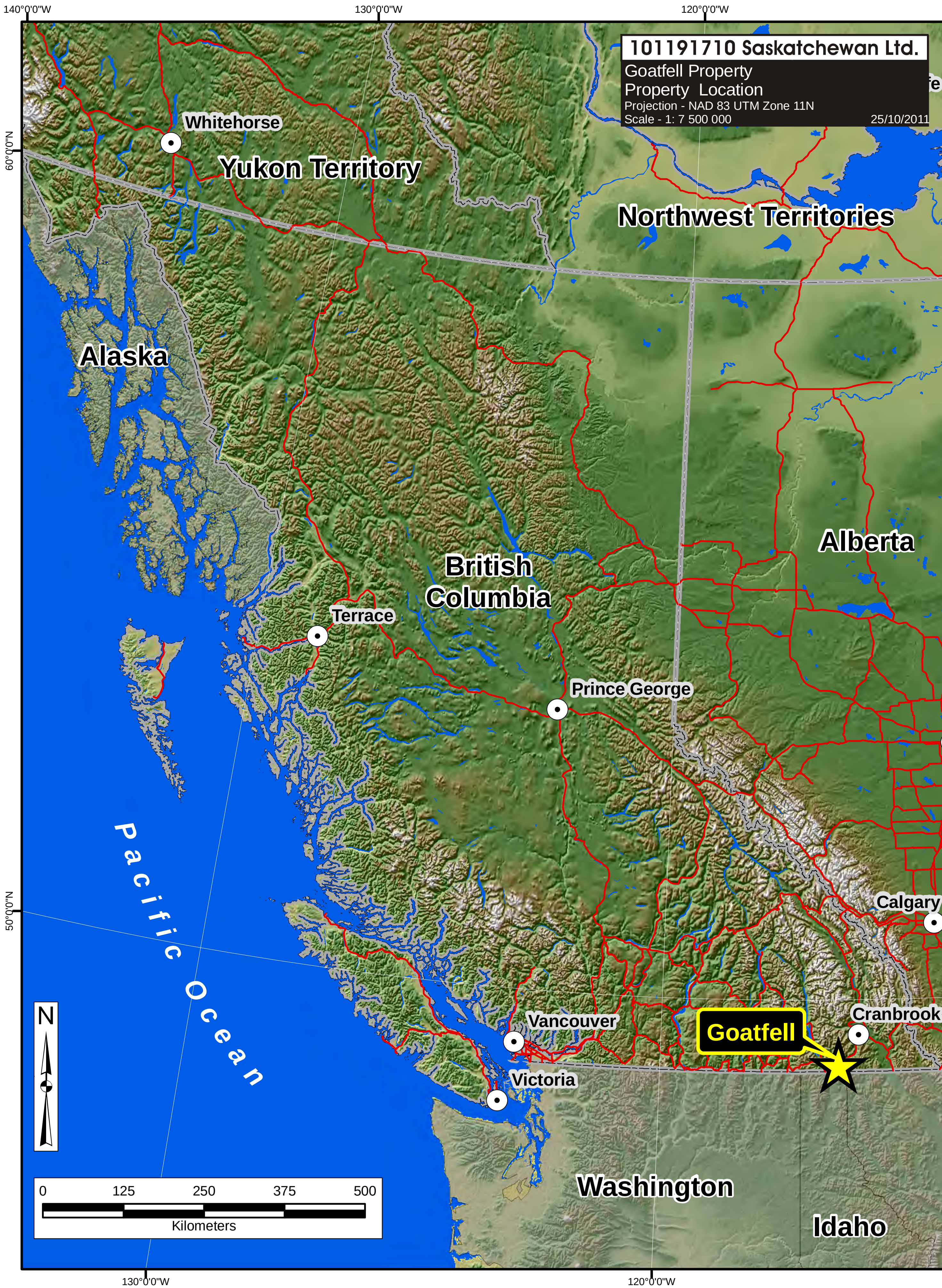
The Goatfell property includes 17 claims covering approximately 7680 hectares. The claims have not been surveyed but claims can be located by reference to GPS coordinates that can be found in the field. There are no mining assets but there are two Minfile showings, Goatfell and Sha South, found on the property. There is adequate land for exploration and development purposes. There are no known environmental issues. Permits must be arranged with the local Mines Inspection personnel in Cranbrook before any program except surface mapping or sampling can proceed. The area lies within the native land claim of the Creston First Nations, part of the K'tunaxa Kinbasket group. Mineral titles are listed below in Table 1 and shown in accompanying Figure 2.

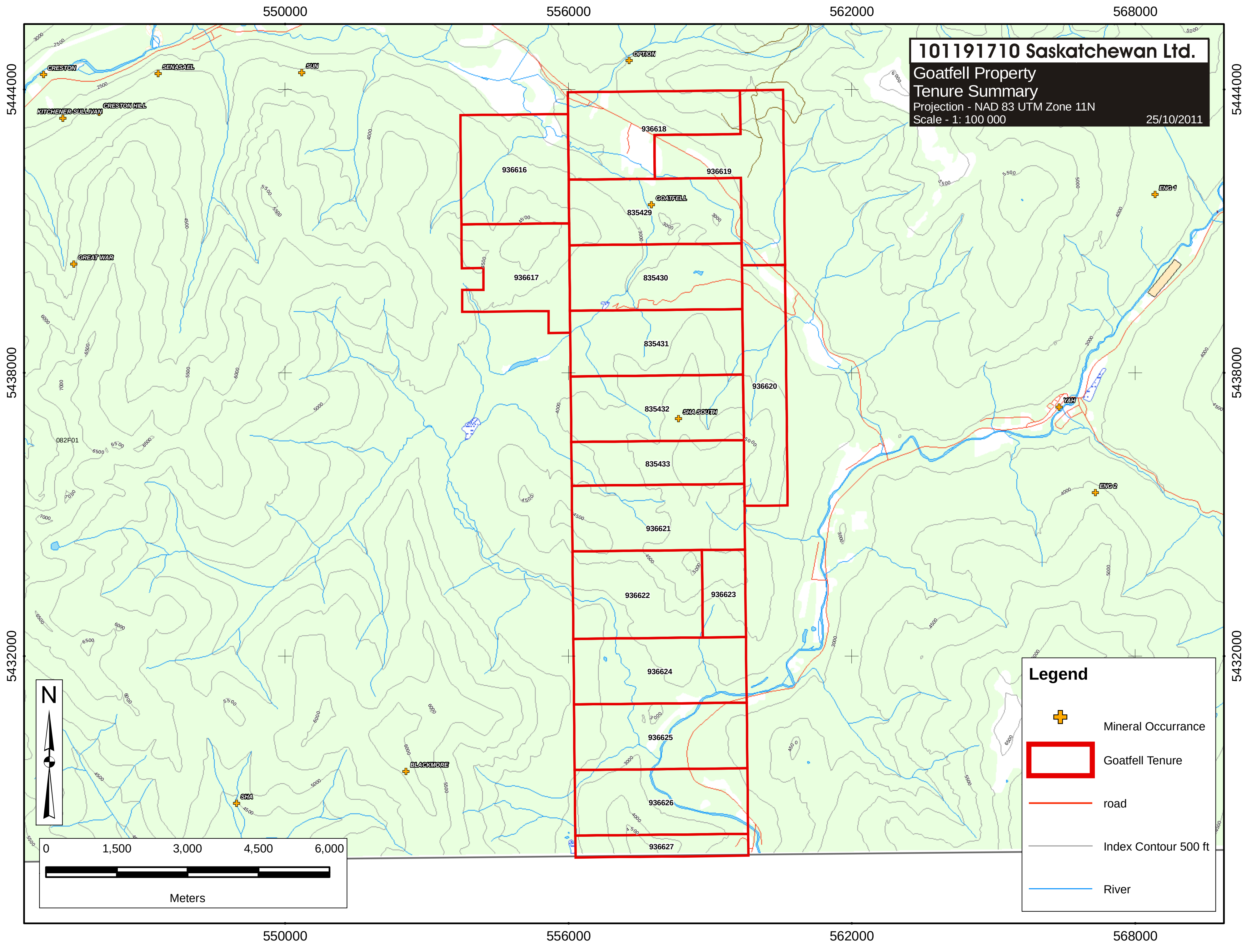
Eagle Plains Resources Ltd. optioned the property to 101191710 Saskatchewan Ltd., a subsidiary of 49 North Resources Inc. (FNR:TSXV), on September 19th, 2011. Whereby 101191710 Saskatchewan Ltd. may earn an undivided 60% interest in Eagle Plains' Goatfell Property located 30 km east of Creston, British Columbia. Under terms of the agreement, 101191710 will complete exploration expenditures of $3,000,000 make cash payments of $250,000 and issue 1,000,000 common shares to EPL over a four year period. The property has no underlying royalties or encumbrances.

Table 1 – List of Tenure

Tenure NO	*Owner*	*NTS*	*Issue Date (MM/DD/YYYY)*	*Good To Date* (MM/DD/YYYY)*	*Area (Ha)*
835429	138073 (100%)	082F	10/8/2010	11/16/2014	507.36
835430	138073 (100%)	082F	10/8/2010	11/16/2014	507.49
835431	138073 (100%)	082F	10/8/2010	11/16/2014	507.62
835432	138073 (100%)	082F	10/8/2010	11/16/2014	507.74
835433	138073 (100%)	082F	10/8/2010	11/16/2014	338.57
936616	138073 (100%)	082F	12/7/2011	12/7/2012	528.42
936617	138073 (100%)	082F	12/7/2011	12/7/2012	422.9
936618	138073 (100%)	082F	12/7/2011	12/7/2012	507.2
936619	138073 (100%)	082F	12/7/2011	12/7/2012	507.29
936620	138073 (100%)	082F	12/7/2011	12/7/2012	465.39
936621	138073 (100%)	082F	12/7/2011	12/7/2012	507.96
936622	138073 (100%)	082F	12/7/2011	12/7/2012	508.11
936623	138073 (100%)	082F	12/7/2011	12/7/2012	169.37
936624	138073 (100%)	082F	12/7/2011	12/7/2012	508.25
936625	138073 (100%)	082F	12/7/2011	12/7/2012	508.38
936626	138073 (100%)	082F	12/7/2011	12/7/2012	508.5
936627	138073 (100%)	082F	12/7/2011	12/7/2012	169.53

*Good to date as of Statement of Work submitted October 26, 2011.


101191710 Saskatchewan Ltd.
Goatfell Property
Property Location
Projection - NAD 83 UTM Zone 11N
Scale - 1: 7 500 000
25/10/2011
140°0'0"W
130°0'0"W
120°0'0"W
60°0'0"N
50°0'0"N
Whitehorse
Yukon Territory
Northwest Territories
Alaska
Alberta
British Columbia
Terrace
Prince George
Pacific Ocean
Calgary
Cranbrook
Goatfell
Vancouver
Victoria
Washington
Idaho
N
0
125
250
375
500
Kilometers


101191710 Saskatchewan Ltd.
Goatfell Property
Tenure Summary
Projection - NAD 83 UTM Zone 11N
Scale - 1: 100 000
25/10/2011
550000
556000
562000
568000
5444000
5438000
5432000
936618
936616
936619
835429
936617
835430
835431
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835432
835433
936621
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936623
936624
936625
936626
936627
CRESTON
SENASAEL
SUN
OPTION
CRESTON HILL
KITCHENER-SULLIVAN
GOATFELL
GREAT WAR
SHA SOUTH
ENG 1
ENG 2
YAH
BLACKMORE
SHA
082F01
N
0
1,500
3,000
4,500
6,000
Meters
Legend
Mineral Occurrance
Goatfell Tenure
road
Index Contour 500 ft
River

Property History

Mining history in the Cranbrook area began with discovery of rich placer gold gravels on Wildhorse Creek, (1863), Moyie River, (1874) and Perry Creek, (1874). Hard rock exploration followed, with the discovery of the Sullivan polymetallic massive sulphide deposit in 1892 and the silver-lead-zinc rich St.Eugene vein deposit in 1893. Although the Sullivan deposit was not recognized as a world-class deposit for many years, and the mineralization of fine-grained base-metal sulphides initially proved troublesome to separate, the St.Eugene vein paid for all its development in the first year of production. The Sullivan mine, now shown to be a sedimentary exhalative ("sedex") deposit, and the St.Eugene mine led to the development of smelting facilities at Trail, B.C., which in turn, encouraged the exploration and development of many smaller mineral deposits in the area, and has provided a genetic and exploration model for these deposits and showings. The property was staked in 1984 by Gordon Leask to cover a tourmalinite altered zone in a geological setting similar to the Sullivan Mine. This occurrence had been recognized in 1977 by Ethier and Campbell. During 1985 prospecting and limited geological mapping was done (Leask, G., 1985). Exploration work specific to the Goatfell property is outlined below:

1986 Geological mapping was done which defined alteration areas and north trending faults, and suggested an east-west-trending "Graben" feature straddling the claim boundary between Goat 1 and Goat 2 claims.

1987 An option was taken on the property by Chevron Minerals Ltd.,(Vancouver). Chevron could acquire 65% interest in the property for $1.5 million exploration expenditures and $1.5 million in property option payments. An additional 35% interest could be purchased for $1.5 million, and the vendors would retain a 3% Net Smelter Return. Almost immediately, 50 per cent interest in the venture was farmed out by Chevron to Formosa Resources Corporation, who had participated in deep drilling projects elsewhere in the Purcell Basin "Sullivan" exploration play. Chevron were operators of the JV. A Transient EM-37 and ground magnetic survey was completed by Orequest/Quantec for the Joint Venture. In addition a rock geochemical program over the Aldridge rocks was done by Edmunds.

1988 A major exploration program was initiated by Chevron for the Joint Venture. Three lines of magnetometer and VLF EM readings were taken to locate the Spider Fault. Geological mapping was done by Murray Hitzman, Ph.D, (Chevron) over 7 square kilometers. A diamond drilling program completed 2 holes of 391 and 453 meters (total 844 meters = 2,768 feet) to test the "Sullivan-time" horizon. Both holes intersected the Spider Creek fault zone and did not reach the target.

1989 Chevron completed a soil sampling grid of 53.5 line kilometers over the Goat and Sky properties, 1,008 soils were tested for 9 elements by ICP and 57 rock samples were tested for 32 elements by ICP. About 2 km of road was built to 2 drill-sites. Drill-holes G-3 of 663.6 meters and hole G-4 of 498 meters, with a total of 1,161.6 meters (3,810 feet) were drilled using HQ and NQ sized core. Petrographic work was done on 20 thin-sections from both properties.

1990 Chevron Minerals Ltd. made a decision to close its Canadian exploration offices, and the property was returned to the Leask syndicates free of any encumbrances. The adjacent Kid-Star property was drilled by Barkhor Resources and partners, resulting in the discovery of sedimentary-exhalative mineralization in the Middle Aldridge at what is now called "Kid" (stratigraphic) time.

1991 Additional geological work was done by Leask and associates; this included prospecting, soil geochemistry, and preparation of geological maps. The geochemical survey defined a significant lead-zinc response within a graben at a stratigraphic position comparable to the Kid property.

1992 Goldpac Investments Ltd. optioned the property, but relinquished the option in 1993

1995, Inmet Mining Corporation conducted an Crone Pulse EM geophysical survey totaling approximately 38.2 line kms. The survey failed to locate any significant conductors.

1995 White Knight Resources drilled 6 diamond drill holes, totaling 2016 m that targeted the favorable Kid-Star stenography of the middle Aldridge Formation. The drillholes intersected minor hydrothermal alteration.

2010 Eagle Plains Resources re-staked lapsed claims

Table 2 – Historic Exploration Expenditures

Year	Operator	Program Cost
1984	Leask syndicates (estimate)	$10,000.00
1985	Leask syndicates	$15,506.47
1987	Chevron/Formosa (estimate)	$50,000.00
1988	Chevron/Formosa	$145,052.00
1989	Chevron/Formosa	$155,043.47
1991	Leask	$7,548.00
1995	Leask / Inmet	$226,606.00
	Total*	**$609,755.94**

* NOTE: These are applied assessment expenditures only, and do not include administration costs, office overhead, or property payments.

Geology

Regional Geology

The property is situated in the Moyie Range of the Purcell Mountains, west of the Rocky Mountain Trench, and on the west flank of the Purcell Anticlinorium. In the Cranbrook area, the Purcell and Rocky Mountain Belt was thrust eastward during Mesozoic and Tertiary times. Major north to northeast-trending faults bound what appears to have been a Proterozoic depositional graben in an extensive clastic basin extending southward into Idaho and Montana in which the Belt-Purcell Supergroup was deposited. Reactivated (growth) faults may have had an influence on deposition of the numerous stratiform massive sulphide deposits, such as the world class Sullivan deposit and smaller North Star, Stemwinder and Kootenay King deposits in the Cranbrook-Fort Steele area. Later northeast-trending faults, such as the Cranbrook and Kimberley faults, may have been transform faults which offset "spreading centres"; these being the focus of major sedimentary exhalative deposits which are preceded by igneous activity and accompanied by areas of tourmaline and albite alteration.

Stratigraphy

Rocks in the area belong mainly to the Purcell Supergroup of Upper Proterozoic age, although Paleozoic Cambrian to Middle Devonian sedimentary rocks occur farther to the north and to the east. The stratigraphy of the Aldridge Formation is briefly summarized below.

The Aldridge Formation is a thick unit (3,500-4,500 meters) of quartzites, siltstones and argillites with graded bedding, rip-up clasts, sole marks, and other characteristics of "turbidite" deposition. The Formation is divided into Lower, Middle and Upper divisions. The lower division has a gradational contact with the Fort Steele Formation below, and consists of dark grey to black argillites, siltstones and quartzites (greywackes). The Middle Aldridge, comprises thick grey quartz-wacke units interbedded with laminated siltstone, and intruded by a number of thick, laterally continuous meta-gabbro sills (greenstone). Repetitive laminations in siltstone-argillite sequences can be correlated for up to 300 km along strike, and are important "marker horizons". The Upper Aldridge includes 300-400 meters of rusty weathering grey argillite and laminated siltstone, and in some places two thick shallow-water dolomite horizons.

The Creston Formation, overlying the Upper Aldridge Formation, is a thick unit (1500 meters) of green, purple, and white quartzite, siltstone and argillite of intertidal to sub-aerial depositional origin, characterized by mud-cracks, ripple marks, rip-up clasts, lead casts and scour and fill structures. Contact with the overlying carbonate unit is gradational.

Intrusive Activity

Several large sills of Purcell age are present in the region (Figure 3), but only the largest ones are shown on the accompanying geological map. These are common in the Aldridge Formations, (but may also be present in stratigraphically higher Proterozoic strata). The "Moyie Sills", predominantly gabbro in composition, have ages identical to the enclosing Aldridge strata (1433 Ma). Hoy (1983) suggests they were emplaced into un-compacted water-saturated sediments. Sulphide accumulations and veins are common adjacent to sill or dyke margins, and the Moyie intrusions are suggested to be part of a thermal/hydrothermal and mineralizing event accompanying rifting in a graben controlled deep clastic basin or graben. A number of sill complexes are present, and rare lamprophyric (minette?) dykes of Cretaceous or Tertiary age also occur.

Other intrusive rocks have been mapped in the area; the nearest large intrusions are the Bayonne batholith, situated 25 kilometers northwest of Goatfell and a quartz monzonitic stock at Kiakho Creek, 30 kilometers northeast of the Goatfell property. Similar stocks also occur across the border in Idaho, about 10 kilometers to the south. Many of the Mesozoic intrusions are associated with mineral deposits or at least have a spatial relationship with mineral prospects.

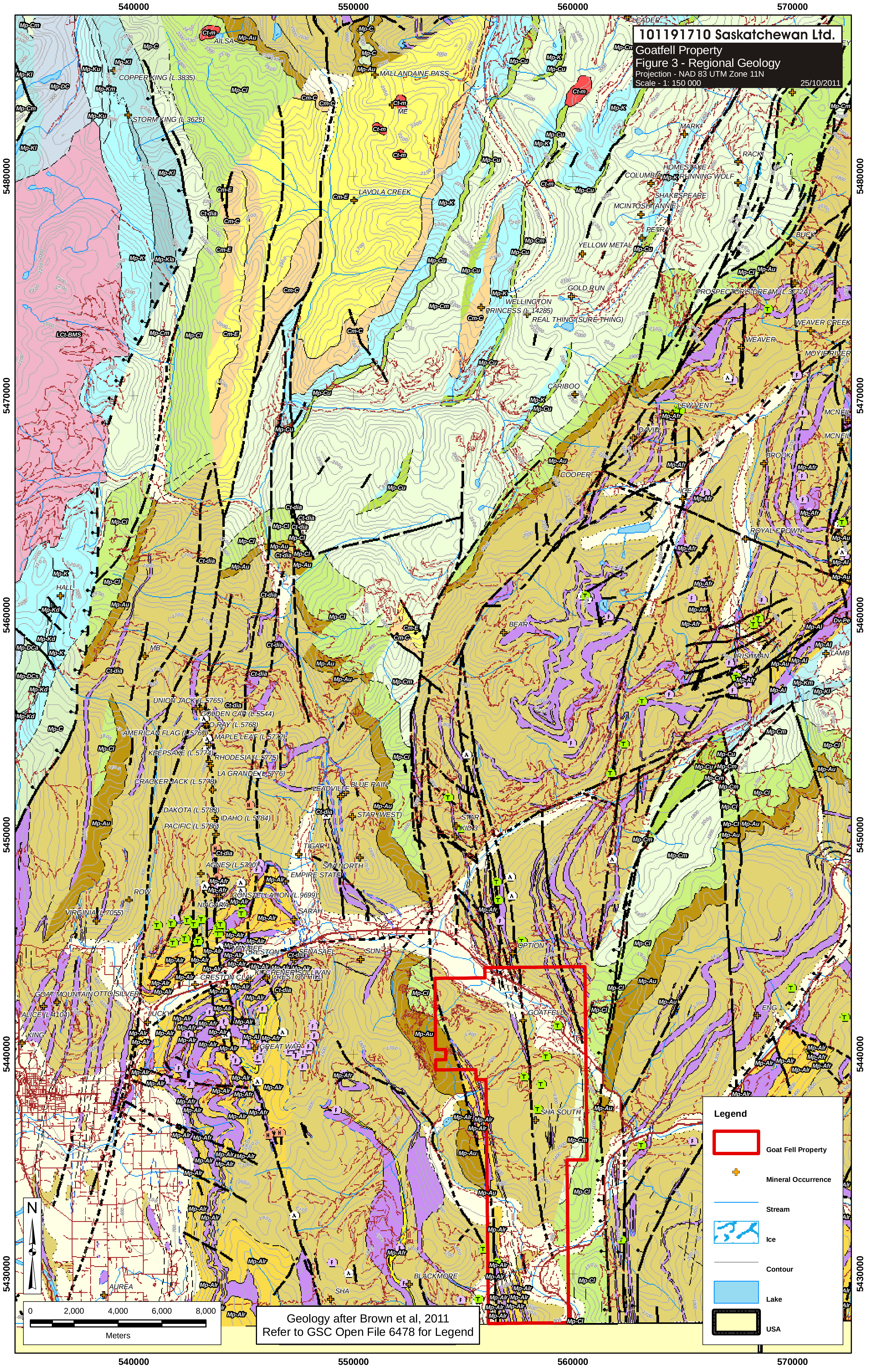
Metamorphism

Greenschist facies regional (static) metamorphism has affected the Aldridge Formation but only weak foliation or recrystallization has resulted. Locally more intense thermal metamorphism has resulted in new biotite hornfelsing, particularly close to some of the Moyie Intrusions.

Structure

The property straddles a major fault, the Moyie fault, which is a steeply-dipping thrust fault with a southwest lateral component of movement about 10-15 kilometers. East of the fault, structure is a simple broad anticline. West of the fault, a number of north-trending reverse thrust faults interrupt a synclinal structure between the Creston valley anticline and the Purcell anticline (Hitzman, 1988). Many of the sills and/or dykes have accompanying shear zones.

Regional geology is shown by the accompanying map, Figure 3.


101191710 Saskatchewan Ltd.
Goatfell Property
Figure 3 - Regional Geology
Projection - NAD 83 UTM Zone 11N
Scale - 1: 150 000
25/10/2011
Legend
Goat Fell Property
Mineral Occurrence
Stream
Ice
Contour
Lake
USA
Geology after Brown et al, 2011
Refer to GSC Open File 6478 for Legend
0
2,000
4,000
6,000
8,000
Meters
N
540000
550000
560000
570000
5480000
5470000
5460000
5450000
5440000
5430000
GOATFELL
SHA SOUTH
COPPER KING (L.3835)
STORM KING (L.3625)
LAVOLA CREEK
MALLANDAINE PASS
YELLOW METAL
GOLD RUN
WELLINGTON
REAL THING (SURE THING)
CARIBOO
COOPER
BEAR
IRISHMAN
ROYAL CROWN
UNION JACK (L.5765)
AMERICAN FLAG (L.5766)
GOAT MOUNTAIN OTTO SILVER
CRESTON CLAY
KITCHENER SULLIVAN
GREAT WAR
BLACKMORE
AUREA
SHA
OPTION
ENG
STAR (WEST)
STAR
TIGAR
SHA NORTH
EMPIRE STATE
BLUE RAIN
LEADVILLE
PROSPECTOR'S DREAM (L.3772A)
WEAVER CREEK
MOYIE RIVER
WEAVER
LEW VENT
DAVID
BROOK
MCNEIL
RACK
MARK
HOMESTAKE
RUNNING WOLF
SHAKESPEARE
COLUMBIA
BUCK
MINTOSH
PETRA
HALL
MB
ROW
VIRGINIA (L.7055)
ALICE (L.4104)
KING
LUCKY
SUN
SARAH
NIAGARA
CONSTELLATION (L.9699)
AGNES (L.5790)
PACIFIC (L.5786)
DAKOTA (L.5789)
IDAHO (L.5784)
CRACKER JACK (L.5778)
LA GRANDE (L.5776)
RHODESIA (L.5775)
KEEPSAKE (L.5774)
MAPLE LEAF (L.5772)
O-RAY (L.5768)
GOLDEN CAT (L.5544)
AILSA
ME
LEADER

Property Geology

Geology of the Goatfell property (Figure 4) has been detailed by Hitzman, (1989) and Rebic (1989) for Chevron Minerals Ltd. Much of the following discussion has been condensed and paraphrased from their excellent reports:

The Goatfell property is underlain by Proterozoic rocks of the Middle Aldridge and Creston Formations, comprised of a turbiditic succession of quartzites, siltites and argillites and intruded by gabbroic to dioritic Moyie sills and dykes. Also intruding this succession are one or more small Cretaceous to Early Tertiary aged lamprophyric dykes.

Stratigraphy

The property is underlain by meta-sedimentary rocks of the late Proterozoic Lower and Middle Aldridge Formations, cut by a number of sills and/or dykes of basic composition (the Moyie Intrusions) and at least one lamprophyric dyke described as a "Minette".

The Lower Aldridge unit has not been mapped in outcrop on the property but was mapped on the adjacent Sky claim by Chevron. The lower Aldridge Formation includes thinly-bedded, rusty-weathering argillite, metasiltstone, metawacke and quartzite. The unit is difficult to distinguish from the lithologically-similar Middle Aldridge Formation; elsewhere, the Middle Aldridge contact is defined where grey quartzite beds begin to predominate in the sequence, but on the Goatfell property, this differentiation is not possible, and the contact is estimated based on stratigraphic distances from the stratigraphic Middle Aldridge markers mapped on the Barb claim to the north and the Goat 3 claim to the south.

The Middle Aldridge Unit, underlying practically all of the property, includes thick meta-sedimentary turbidite beds of grey quartzite, greywacke, siltstone and argillite. The quartzites and wackes are most common, with beds from 0.25 to 4 meters thick. The stratigraphic markers are silty and argillaceous units with characteristic spacing of light and dark laminae that can be matched lamina for lamina over distances up to 300 kilometers in the basin. On Hazel Ridge on the Barb claim, the "Sundown" and "Moyie" markers were identified in outcrop and the "Park" marker was tentatively identified. Several un-identified markers were seen in drill-core. A listing of the markers and distances above the Sullivan Time Horizon is given below:

Table 3 – Purcell Basin Stratigraphic Markers (After Brown et. al., 2011 GSC OF6153)

Marker Name	Distance to Sullivan Time (LMC)
Sundown	988m (Identified on property)
Kid	917m
Moyie	860m (Identified on property)
Park	677m (Tentative)
Lamb / Beehive	605m
Hiawatha	475m
Lois Creek	305m
Fringe	185m

Without these stratigraphic markers, it is impossible to ascertain the stratigraphic position of any feature. Considerable additional study of markers horizons in the area will be necessary to better define the Aldridge stratigraphy.

From the outcrop mapping and examination of the drill-core, it is evident that the Middle Aldridge Formation on the Goatfell claims has undergone a substantial thickening. This is regarded as evidence of the development of a "third order" sub-basin or graben-margin basin within which sedimentary exhalative mineralization might have accumulated. Near the northern tourmalinite, thick channeled sedimentary units occur at "Kid Time" near the Moyie marker. The suspected position of the mineralization adjacent to the Moyie marker is derived from the "sedex" mineralization at this stratigraphic position on the Kid-Star property to the north, the lead-zinc-bearing chaotic tourmalinite breccia in the proposed footwall, and the anomalously thick sedimentary prism located in this area above the Moyie marker, all of which suggest tectonic instability was initiated in this area slightly later than the Sullivan time.

Intrusive Rocks

Moyie sills are numerous in the claim area; these rocks vary from meta-gabbro to meta-diorite and are dark green fine to coarsely-crystalline. Most of the sills contain 40-60% hornblende, 15-40% plagioclase, 10-20% quartz, and accessory biotite, garnet, magnetite, apatite, sphene, rutile, leucoxene, carbonate, and epidote or clinozoisite. The sills are irregular in thickness and distribution and are up to 100 meters in thickness. They may contain pyrite, pyrhhotite and chalcopyrite, and occasionally galena and sphalerite. In some cases, dykes may be present, and may give rise to dyke-sill intrusive complexes. These may be important spatially in the localization of mineralization. At the Sullivan deposit (see

Appendix III) a broad intrusive arch has granophyric components that appear to be genetically related to some of the mineralization.

A meter-thick lamprophyre sill and a 30 cm wide dyke are present adjacent to the railway. Similar dykes noted by Rice (1941) at the Sullivan Mine were believed by him to be Tertiary in age.

Structure

According to Hitzman (1989) the property may be divided into three structural blocks:

1. An eastern block, east of the Moyie Fault; in this block sediments strike nearly north-south and dip moderately (40-45 degrees) to the west.

2. A central block, between the Moyie thrust Fault and the Spider Creek back-fault, in which sediments strike north south and dip 45-60 degrees (average 55 degrees) eastward.

3. A western block, west of the Spider Creek Fault, in which uppermost Middle Aldridge sediments strike North-northwest and dip 60-80 degrees east.

Movement on the Moyie Thrust is thought to be 12-15 kilometers of southeasterly-directed displacement. Offset on the Spider Creek fault is suggested to be 3,000 meters (right lateral) based on offset of marker beds within the Middle Aldridge Formation. The Spider Creek fault is up to 50 meters wide. The above-noted generalized structural interpretation is complicated by additional suspected north-trending faults east of the Spider Fault, and suspected east-west cross-faults, many of which are based on air-photo linears and thick channel-fill beds. One or more west-trending shears or faults were seen in the railway exposures near Carroll Creek. Minor folding of small magnitude was seen at the Sky tourmaline-sulphide zone and in drill core; this may be related to local slumps and fault structure.

Alteration and Mineralization

Two distinctive styles of alteration are present on the Goatfell Property: tourmaline alteration and quartz-chlorite-pyrite. Tourmaline is present in several areas on the claim block:

1. An oval-shaped area about 500 meters x 300 meters on the railway about 300 meters west of the Goat 1/Goat 2 Legal corner-post. At this locality, alteration varies from moderately disseminated tourmaline needles to hard black cherty-looking rock which is essentially 100 percent fine, felted tourmaline with patches and fragments of sphalerite and galena.

2. A large area of tourmalinite float along the Spider Creek fault (Goatfell showing; Figure 4) and extending southward. This occurrence was not mapped in detail, but consists of a tourmalinite rock with chaotic fragments of quartz-chlorite-pyrite rock and of sphalerite and galena.

The tourmaline alteration is regarded as "early" boron metasomatism and is spatially associated with graben margins at many places in the Purcell basin, or as footwall-hosted vents or feeder-pipes at the Sullivan deposit.

Quartz-chlorite-pyrite alteration is noted as a bleached appearance in the Aldridge metasediments, particularly in the vicinity of the C.P. railway loop. The alteration extends about 1.2 kilometers southward along the Spider Creek fault, but narrows toward the eastern tourmalinite zone on the railway. Drillholes 1 and 2 exhibit this alteration type along almost their entire length. The alteration is associated with hair-line greenish veins with calcite centers that cut the bedding at high angles. The green coloration is caused by sericite, chlorite and carbonate. Thin-section examination indicated that the pervasive bleaching associated with this alteration is caused by removal of biotite and some opaque minerals, re-crystallization of quartz and fine-grained mica, and addition of carbonate minerals. (Hitzman, 1989). This alteration cuts the contact metamorphic biotite.

The quartz-chlorite (sericite)-pyrite alteration is regarded as a later hydrothermal event, perhaps as "footwall" alteration associated with a feeder zone for sedimentary-exhalative mineralization. Mineralization on the property is, as yet, limited to numerous quartz veins seen in core, containing galena, sphalerite, pyrite, and chalcopyrite, with minor tetrahedrite or arsenopyrite, and elevated gold values, and significantly, as sulphide fragments in the tourmalinite pipe on the western part of the property.

Property Mineralization

Goatfell Occurrence

As described in Minfile: "The Goatfell occurrence is located along the CPR railway about 1.5 kilometres west of Carroll Creek. This occurrence includes an extensive area of tourmalinite float, 2.5 kilometres to the south of the Goatfell tourmalinite body. The float contains galena and sphalerite in an intensely brecciated tourmalinized matrix.

The occurrence lies within the Middle Proterozoic Purcell Supergroup, a thick succession of siliciclastic and lesser carbonate rocks. This sedimentary succession contains the Sullivan deposit (082FNE052), one of the world's largest massive sulphide sedimentary-exhalative lead-zinc deposits which lies approximately 70 kilometres to the north. Stratigraphically, this deposit is hosted by the Aldridge Formation, at the Lower Aldridge/Middle Aldridge contact.

The Goatfell occurrence is related to a body of tourmalinite (the Goatfell tourmalinite) that crosscuts Middle Aldridge sediments in the structural panel between the Spider and Moyie faults. The tourmalinization of the sediments varies, reflecting original lithologies, and is semi-concordant. The sediments are quartz wackes, quartzites and argillites.

The tourmalinite alteration zone is cut to the west by the Spider fault, a steeply eastward dipping reverse fault. A zone of silicification and muscovite alteration occurs in the hangingwall of the Spider fault and may be unrelated to the tourmalinite zone.

Four diamond-drill holes in the footwall of the Goatfell tourmalinite in 1988-1989 were focused on testing the Sullivan time horizon (the projected Lower-Middle Aldridge contact). Minor tourmalinite and fracture controlled sphalerite and galena was intersected in these holes. No drilling has been conducted in the hangingwall of the Goatfell tourmalinite.

An extensive area of tourmalinite float, containing galena and sphalerite within an intensely brecciated tourmalinized matrix, occurs about 2.5 kilometres to the south (Assessment Report 21939)".

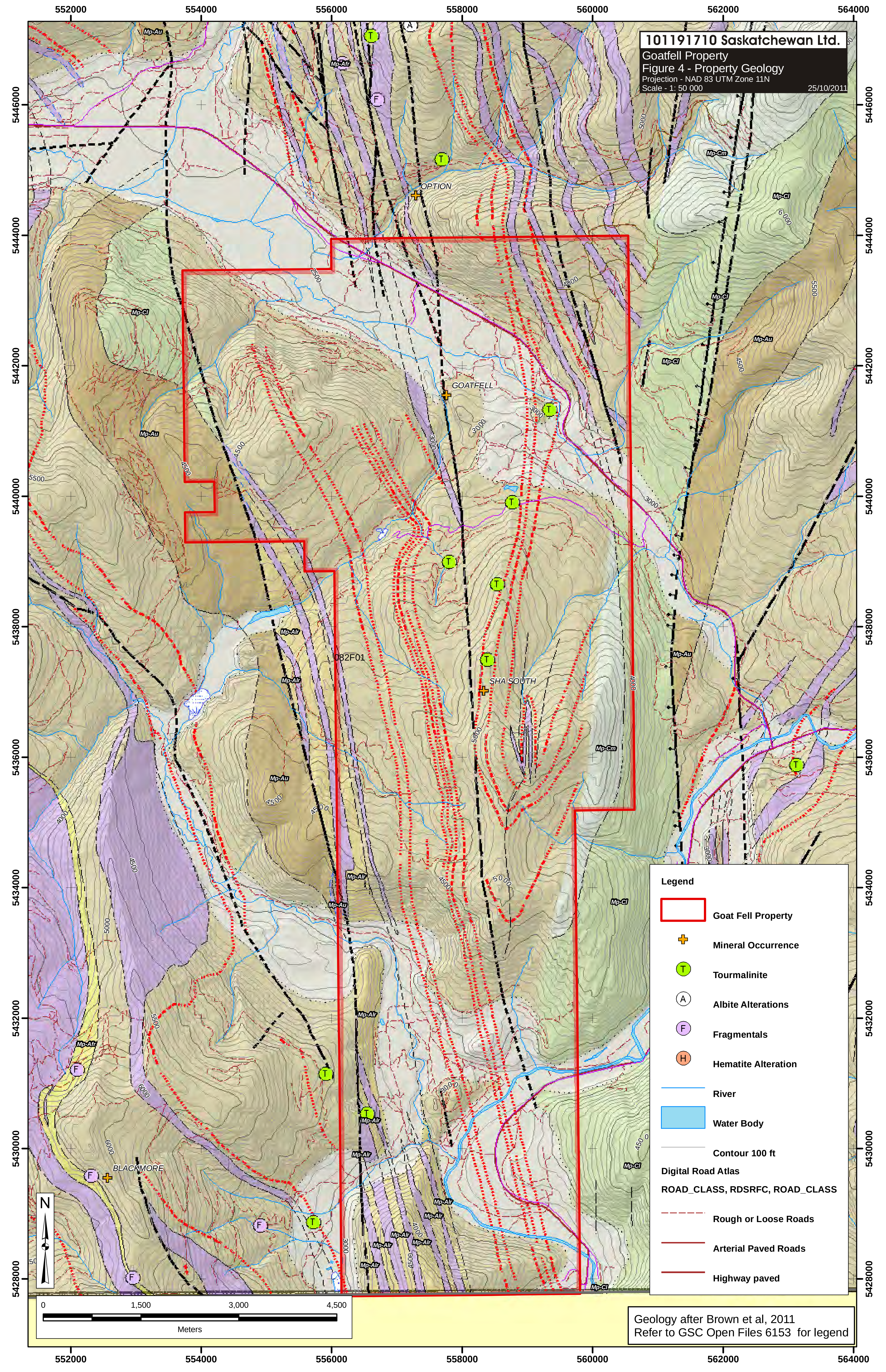
Sha Showing

As described in Minfile: "The original Sha property was a large Cominco property situated to the south of the Goatfell property. The Sha South showing is now included in the Goatfell claims. Geology is essentially similar, with East-dipping Lower and Middle Aldridge meta-sediments cut by a number of north-trending faults, including the Kid Creek, Iron Mountain, Spider Creek, Hazel Creek and Moyie Faults, and intruded by Moyie dykes and sills. A great deal of assessment work including soil geochemical surveys and geophysical surveys have been done. Several coincident lead-zinc soil anomalies have been located. Minfile describes the showing as a geochemical anomaly as follows:

The Sha South geochemical anomaly is located on the (previous) Sha 29 and 30 claims, approximately 8 kilometres west of Yahk (Assessment Report 22057). Reconnaissance geophysical surveys by UTEM (University of Toronto electromagnetic) method disclosed several low-level conductors on the claims (Assessment Reports 17044, 18163, 18164). Earlier horizontal-loop electromagnetic and ground magnetic surveys had also shown several weak conductors and anomalies (Assessment Report 11210).

The area is underlain by the peri-cratonic Middle Proterozoic Purcell Supergroup, a thick succession of siliciclastic and lesser carbonate rocks. The claims are underlain by quartzitic turbidites and argillaceous siltstones of the Middle Aldridge Formation. No mineralization is reported, but spot highs of up to 200 parts per million lead and 250 parts per million zinc were found in soil samples (Assessment Reports 15025, 22057).

References: Assessment Reports No's 11210, 15109, 15025,18163, 16181, 17044, 17775, 17044, 18164. *22057, 23866, 23961 Minfile 82FSE 076,089".



101191710 Saskatchewan Ltd.
Goatfell Property
Figure 4 - Property Geology
Projection - NAD 83 UTM Zone 11N
Scale - 1: 50 000
25/10/2011
OPTION
GOATFELL
SHA SOUTH
BLACKMORE
082F01
Legend
Goat Fell Property
Mineral Occurrence
Tourmalinite
Albite Alterations
Fragmentals
Hematite Alteration
River
Water Body
Contour 100 ft
Digital Road Atlas
ROAD_CLASS, RDSRFC, ROAD_CLASS
Rough or Loose Roads
Arterial Paved Roads
Highway paved
0
1,500
3,000
4,500
Meters
N
Geology after Brown et al, 2011
Refer to GSC Open Files 6153 for legend

2011 Work Program

2011 exploration on the Goatfell property consisted of of two airborne geophysical surveys (Figure 5a and 6a) that were flown in conjunction with four other properties in the Purcell Basin. An airborne EM survey (VTEM) was flown by GeoTech Limited, a geophysical contractor based in Aurora, Ontario. An airborne gravity gradiometry (AGG) survey was flown by Fugro Airborne Surveys of Mississauga, Ontario. The 138.1 line km VTEM survey was flown in one day (Oct. 19, 2011) and the 242.3 line km AGG survey was hampered by poor weather, thus was completed over a 3 day period between October 25^{th} to October 27^{th}, 2011. Total cost of the 2011 exploration program was $103,058.80. Details of the individual surveys are below.

Geotech Airborne EM Survey (VTEM)

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

During the survey the helicopter was maintained at a mean altitude of 174 meters above the ground with a nominal survey speed of 80 km/hour. This allowed for a nominal EM bird terrain clearance of 119 meters and a magnetic sensor clearance of 161 meters.

The electromagnetic system was a Geotech Time Domain EM (VTEM plus) system. The VTEM plus Receiver and transmitter coils were in concentric-coplanar and Z-direction oriented configuration. The receiver system for the project also included a coincident-coaxial X-direction coil to measure the in-line dB/dt and calculate B-Field responses. The EM bird was towed at a mean distance of 35 meters below the aircraft.

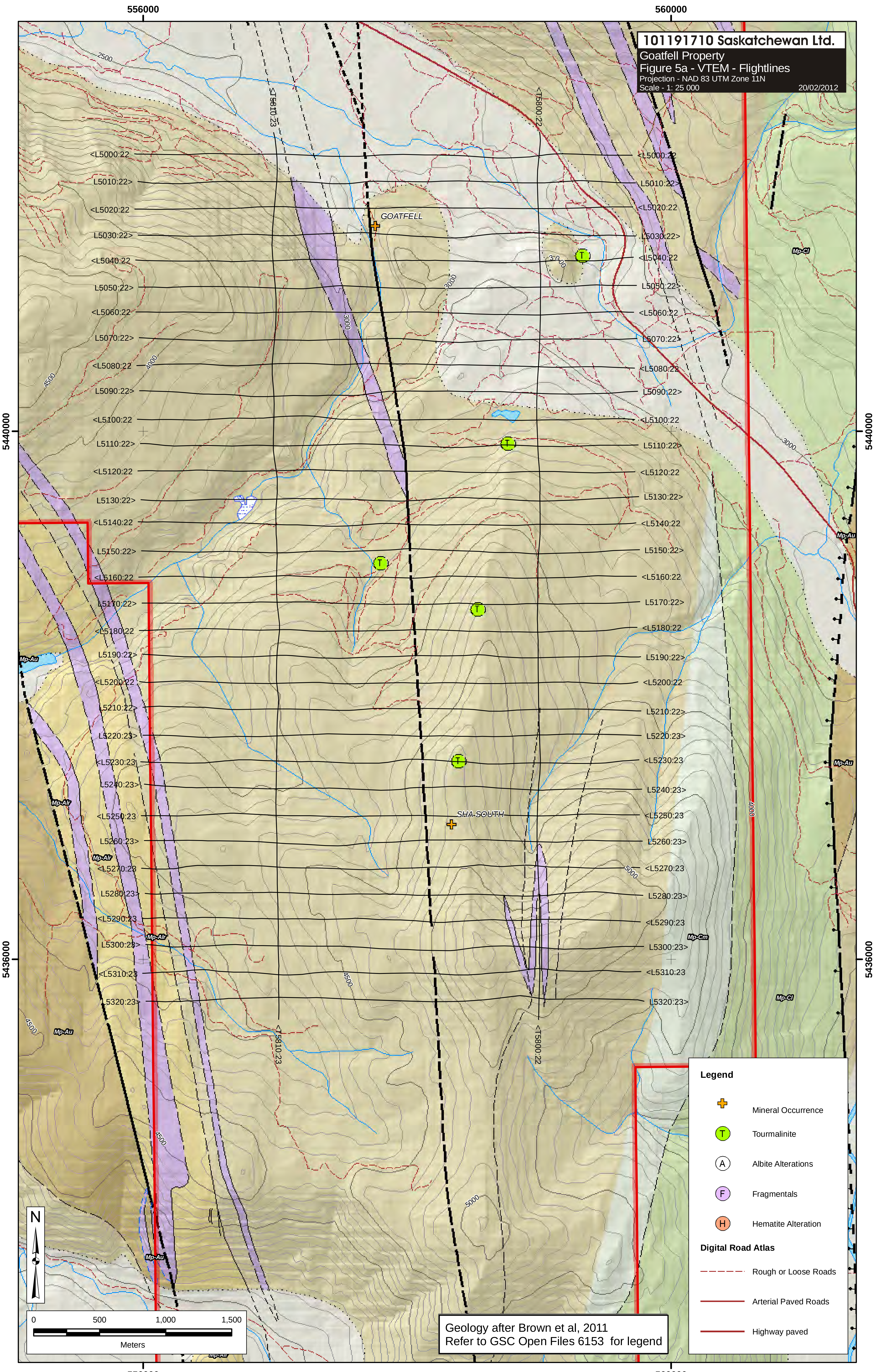
The magnetic sensor utilized for the survey was Geometrics optically pumped caesium vapour magnetic field sensor mounted 13 metres below the helicopter. The sensitivity of the magnetic sensor is 0.02 nanoTesla (nT) at a sampling interval of 0.1 seconds.

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.

The navigation system used was a Geotech PC104 based navigation system utilizing a NovAtel's CDGPS (Canada-Wide Differential Global Positioning System Correction Service) enable OEM4-G2-3151W GPS receiver, Geotech navigate software, a full screen display with controls in front of the pilot to direct the flight and an NovAtel GPS antenna mounted on the helicopter tail. As many as 11 GPS and two CDGPS satellites may be monitored at any one time. The positional accuracy or circular error probability (CEP) is 1.8 m, with CDGPS active, it is 1.0 m. The co-ordinates of the block were set-up prior to the survey and the information was fed into the airborne navigation system.

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.

See Appendix III for details pertaining to the survey parameters, QAQC and data processing.


101191710 Saskatchewan Ltd.
Goatfell Property
Figure 5a - VTEM - Flightlines
Projection - NAD 83 UTM Zone 11N
Scale - 1: 25 000
20/02/2012
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560000
5440000
5436000
GOATFELL
SHA SOUTH
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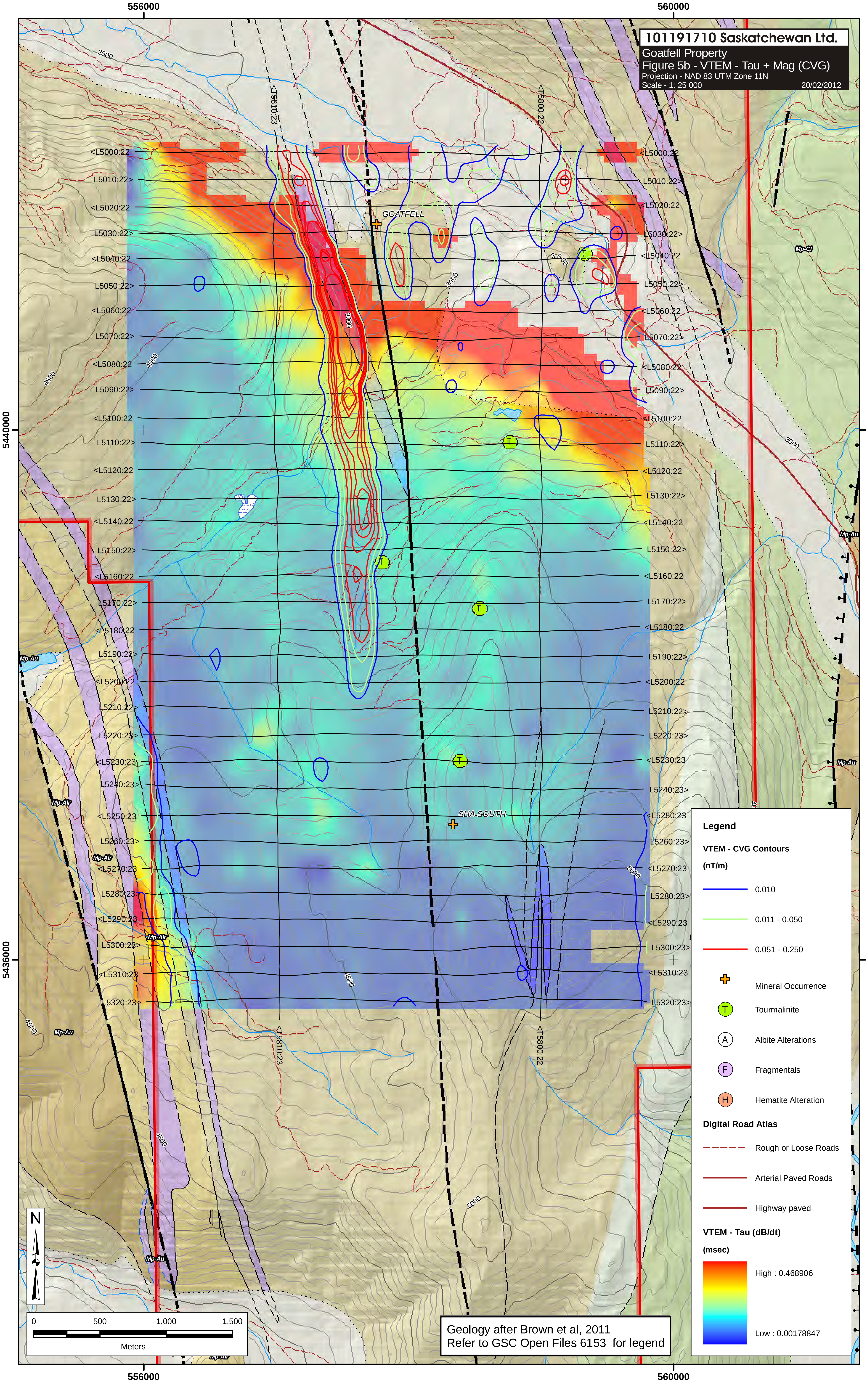
L5320:23>
Mp-Cl
Mp-Au
Mp-Alr
Mp-Cm
2500
3000
4000
4500
5000
Legend
Mineral Occurrence
Tourmalinite
Albite Alterations
Fragmentals
Hematite Alteration
Digital Road Atlas
Rough or Loose Roads
Arterial Paved Roads
Highway paved
N
0
500
1,000
1,500
Meters
Geology after Brown et al, 2011
Refer to GSC Open Files 6153 for legend


101191710 Saskatchewan Ltd.
Goatfell Property
Figure 5b - VTEM - Tau + Mag (CVG)
Projection - NAD 83 UTM Zone 11N
Scale - 1: 25 000
20/02/2012
556000
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5440000
5436000
<T5810:23
<T5800:22
<L5000:22
L5010:22>
<L5020:22
L5030:22>
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L5300:23>
<L5310:23
L5320:23>
GOATFELL
SHA SOUTH
Mp-Cl
Mp-Au
Mp-Alr
Legend
VTEM - CVG Contours
(nT/m)
0.010
0.011 - 0.050
0.051 - 0.250
Mineral Occurrence
Tourmalinite
Albite Alterations
Fragmentals
Hematite Alteration
Digital Road Atlas
Rough or Loose Roads
Arterial Paved Roads
Highway paved
VTEM - Tau (dB/dt)
(msec)
High : 0.468906
Low : 0.00178847
N
0 500 1,000 1,500
Meters
Geology after Brown et al, 2011
Refer to GSC Open Files 6153 for legend

2011 Fugro AGG Survey

The HeliFALCON survey was based out of the Creston Valley Airport. A total of seven field personnel were involved with the program. A Great Slave Helicopters owned Eurocopter AS350-B3 with Canadian registration C-GYAV, was used to fly the survey area. Terrain clearance for the survey averaged well above the nominal clearance of 30 m having a mean value of 107.3 m across the survey areas. The terrain clearances, as derived from laser scanner data, are shown in Figure 7 of Appendix IV. The following parameters were recorded during the course of the survey:

- HeliFALCONTM AGG data: recorded at different intervals.
- Aircraft altitude: measured by the barometric altimeter at intervals of 0.1 s.
- Terrain clearance: provided by the radar altimeter at intervals of 0.1 s.
- Airborne GPS positional data (latitude, longitude, height, time and raw range from each satellite being tracked): recorded at intervals of 1 s.
- Time markers: in digital data.
- Ground total magnetic field: recorded with a 1 s sampling rate.
- Ground based GPS positional data (latitude, longitude, height, time and raw range from each satellite being tracked): recorded at intervals of 1 s.
- Aircraft distance to ground: measured by two laser scanners, scanning at 20 times per second (when in range of the instrument and in the absence of thick vegetation).

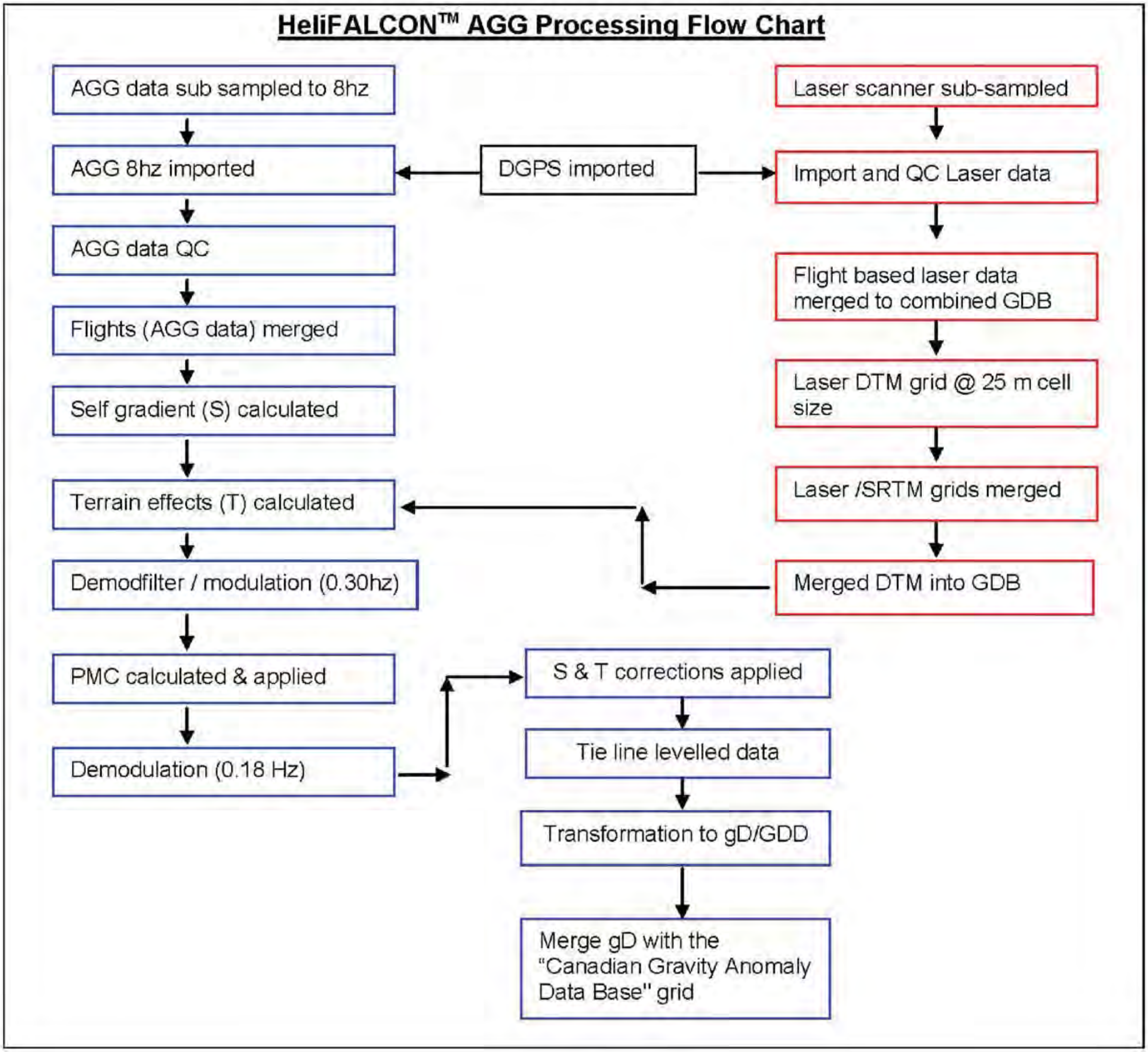
A dual frequency GPS base station was set up close to Creston airport runway in order to correct the raw GPS data collected in the aircraft. A secondary GPS base station was available close to the primary GPS base but was not required.

During the course of the survey there were no data quality issues with any of the survey parameters.

The HeliFALCON Airborne Gravity Gradiometer data were digitally recorded by the AGG Data Acquisition System (ADAS) on removable hard drives. The raw data were then copied on to the field processing laptop, backed up twice onto DVD+R media and shipped to Fugro Perth using a secure courier service. Preliminary processing and QC of the HeliFALCONTM AGG data were completed on-site using Fugro's DiAGG software. Further QC and Final HeliFALCONTM AGG data processing were performed by the office based data processor. HELIFalcon flight turbulence and system noise are presented in Appendix IV as Figures 3 and 4. A flow chart of the Helifalcon AGG data processing is presented in Figure 6 of this report.

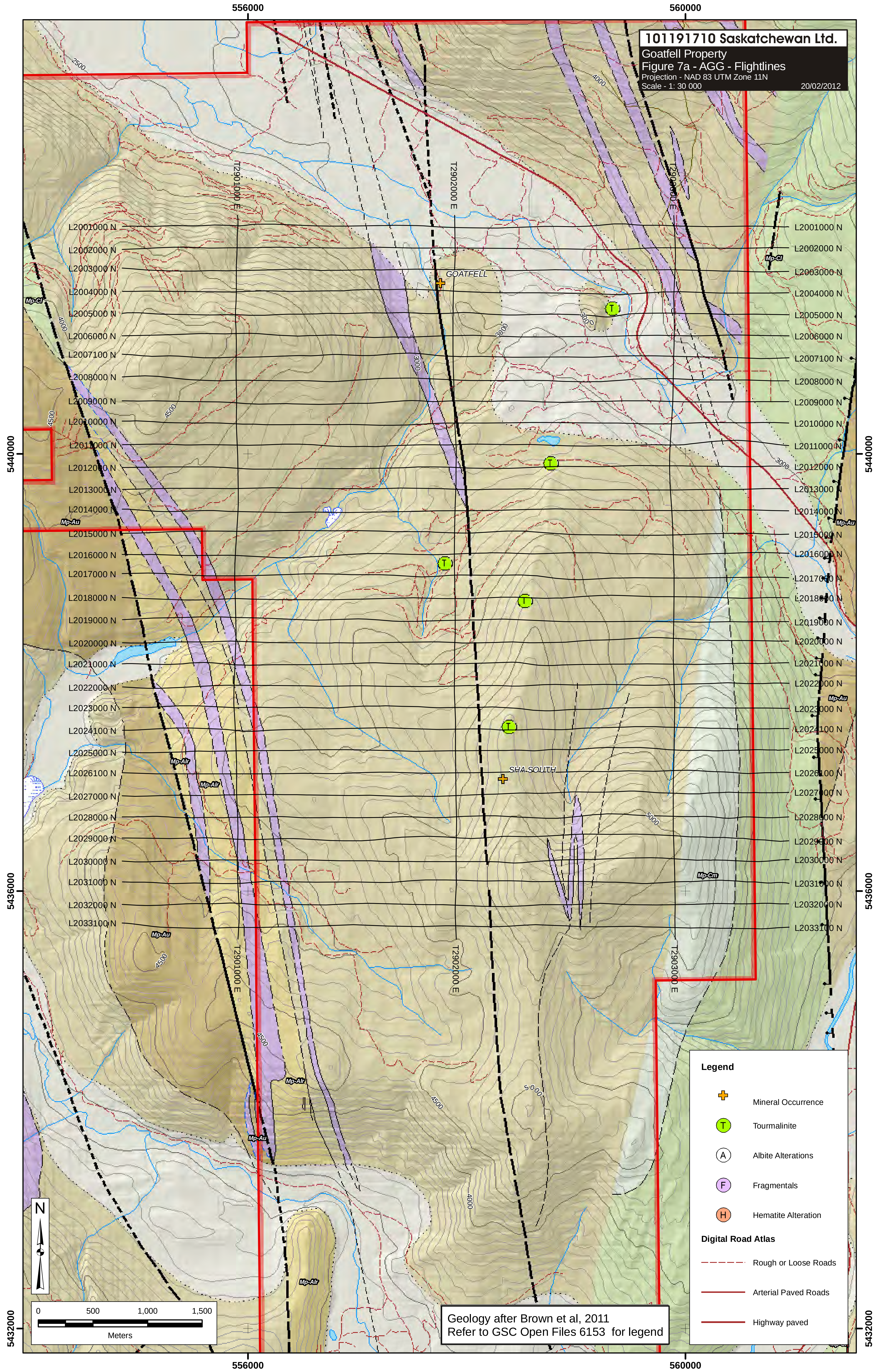
A detailed logistics report from Fugro is presented in Appendix IV.

101191710 Saskatchewan Ltd.
Goatfell Property
Figure 6 - Fugro AGG Data Flow

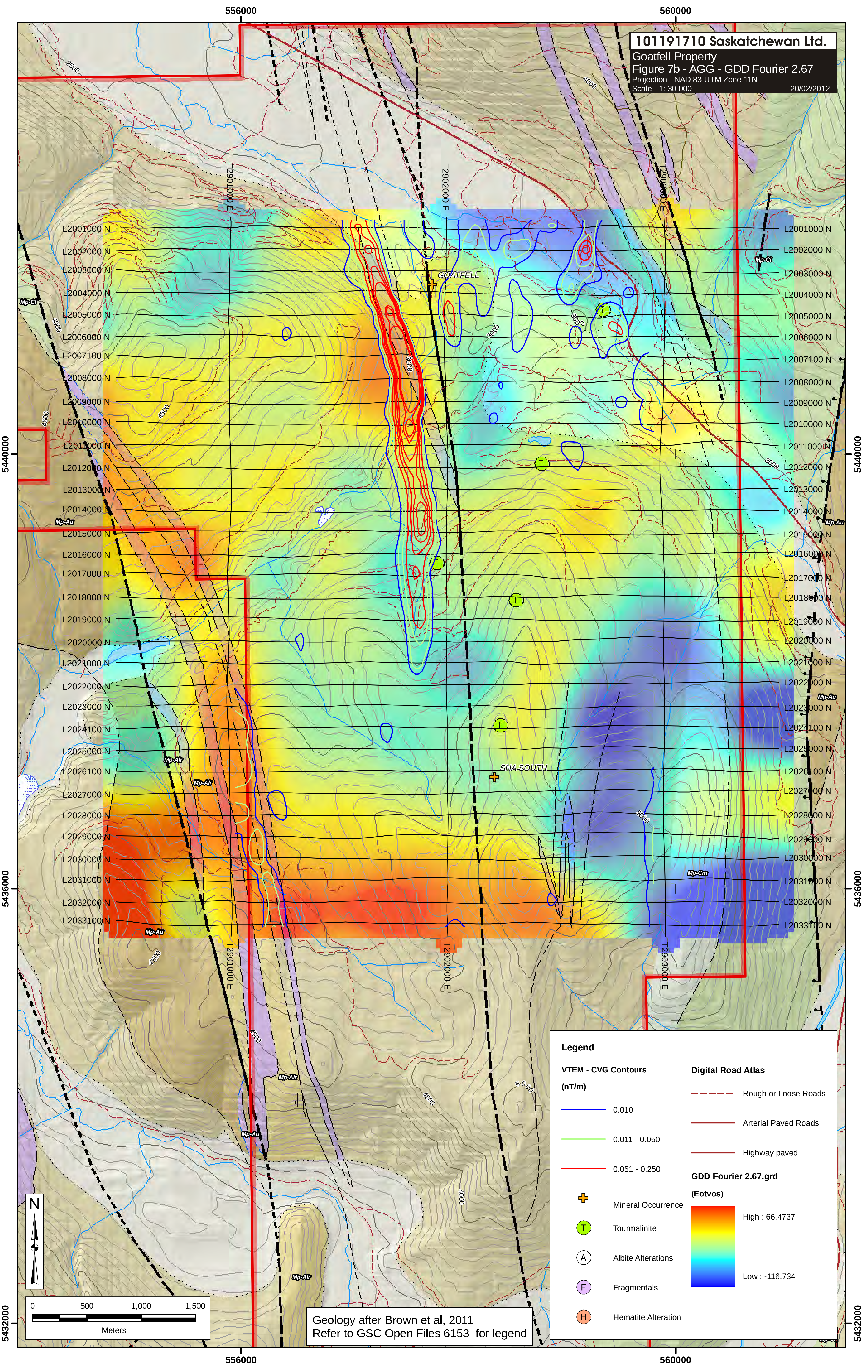


2011 Program Results

- The Geotech airborne EM survey identified two conductive zones along the North-Eastern limits of the survey area (Figure 5b).
  - unfortunately both of these anomalies are cultural in nature and represent train tracks (1) and powerlines (2).
  - there is also a very well defined North-South trending magnetic lineament that is present in the center of the property and is spatially correlated with either a Moyie intrusive or a major North-South striking Spider Fault
  - interestingly enough none of the other mapped Moyie sills in the survey area show strong magnetic anomalies
- The results of the Fugro HeliFALCON AGG survey are presented in Figures 7b (Vertical Gravity Gradient – Fourier Processing – 2.67 g/cm3) and Figure 7c (Vertical Gravity – Fourier Processing – Conformed to Regional Gravity).
  - Figure 7b shows a number of gravity highs that correlate with mapped Moyie Sills on the property, but there is also an isolated (yet multiline) gravity high that spatially correlates with the Mag CVG high delineated in the VTEM survey
  - results presented in Figure 7c for the vertical gravity are much coarser but do show a strong gravity high anomaly in the South-Western portion of the survey
    - it is not possible to explain this anomaly with the current surficial bedrock geology



101191710 Saskatchewan Ltd.
Goatfell Property
Figure 7a - AGG - Flightlines
Projection - NAD 83 UTM Zone 11N
Scale - 1: 30 000
20/02/2012
556000
560000
5440000
5436000
5432000
T2901000 E
T2902000 E
T2903000 E
L2001000 N
L2002000 N
L2003000 N
L2004000 N
L2005000 N
L2006000 N
L2007100 N
L2008000 N
L2009000 N
L2010000 N
L2011000 N
L2012000 N
L2013000 N
L2014000 N
L2015000 N
L2016000 N
L2017000 N
L2018000 N
L2019000 N
L2020000 N
L2021000 N
L2022000 N
L2023000 N
L2024100 N
L2025000 N
L2026100 N
L2027000 N
L2028000 N
L2029000 N
L2030000 N
L2031000 N
L2032000 N
L2033100 N
GOATFELL
SHA-SOUTH
Mp-Cl
Mp-Au
Mp-Alr
Mp-Cm
N
0
500
1,000
1,500
Meters
Geology after Brown et al, 2011
Refer to GSC Open Files 6153 for legend
Legend
Mineral Occurrence
Tourmalinite
Albite Alterations
Fragmentals
Hematite Alteration
Digital Road Atlas
Rough or Loose Roads
Arterial Paved Roads
Highway paved



101191710 Saskatchewan Ltd.
Goatfell Property
Figure 7b - AGG - GDD Fourier 2.67
Projection - NAD 83 UTM Zone 11N
Scale - 1: 30 000
20/02/2012
556000
560000
5440000
5436000
5432000
GOATFELL
SHA SOUTH
T2901000 E
T2902000 E
T2903000 E
L2001000 N
L2002000 N
L2003000 N
L2004000 N
L2005000 N
L2006000 N
L2007100 N
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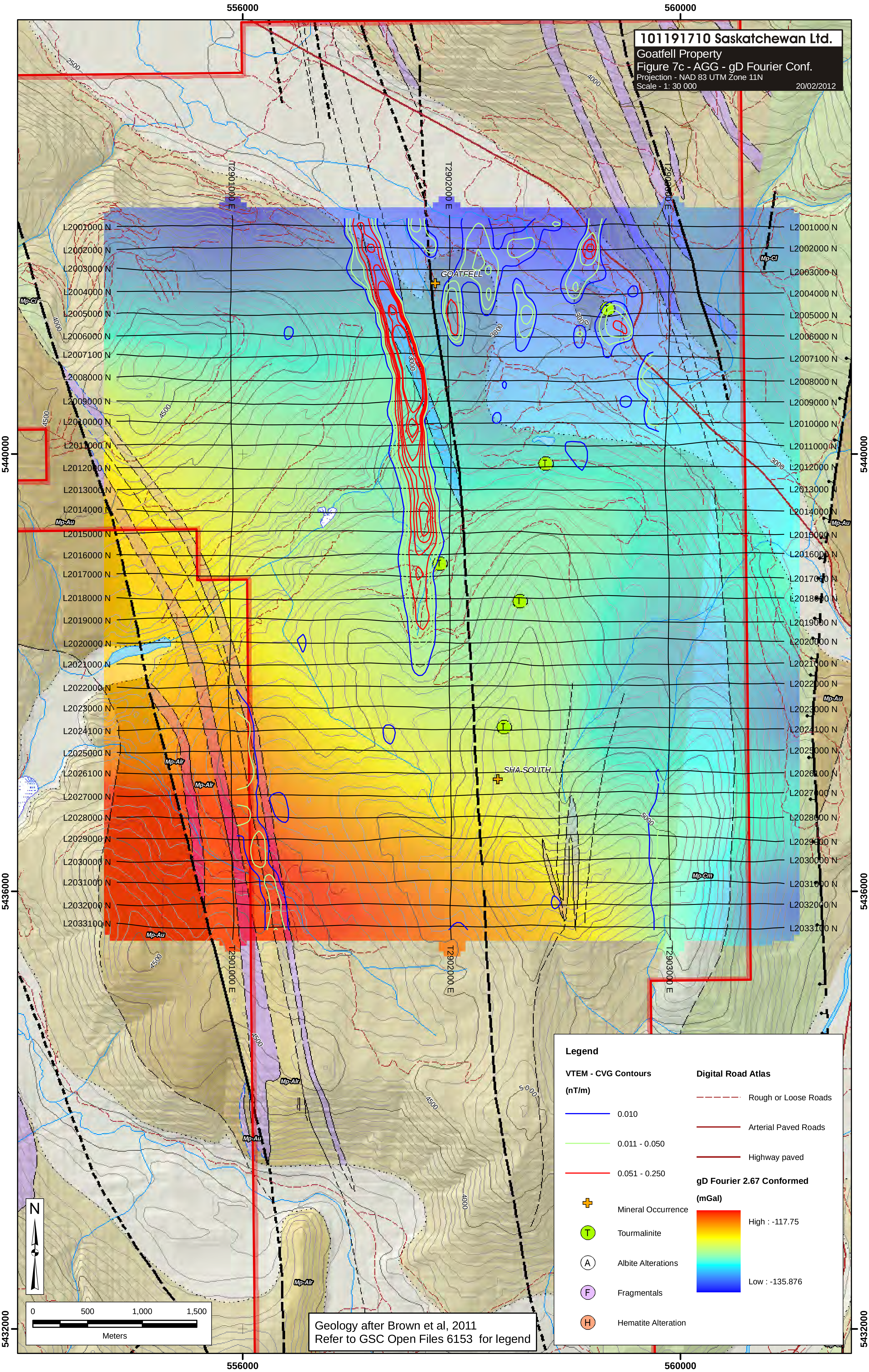
L2025000 N
L2026100 N
L2027000 N
L2028000 N
L2029000 N
L2030000 N
L2031000 N
L2032000 N
L2033100 N
Mp-Cl
Mp-Au
Mp-Alr
Mp-Cm
Legend
VTEM - CVG Contours (nT/m)
0.010
0.011 - 0.050
0.051 - 0.250
Mineral Occurrence
Tourmalinite
Albite Alterations
Fragmentals
Hematite Alteration
Digital Road Atlas
Rough or Loose Roads
Arterial Paved Roads
Highway paved
GDD Fourier 2.67.grd
(Eotvos)
High : 66.4737
Low : -116.734
N
0
500
1,000
1,500
Meters
Geology after Brown et al, 2011
Refer to GSC Open Files 6153 for legend


101191710 Saskatchewan Ltd.
Goatfell Property
Figure 7c - AGG - gD Fourier Conf.
Projection - NAD 83 UTM Zone 11N
Scale - 1: 30 000
20/02/2012
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5432000
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T2903000 E
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L2003000 N
L2004000 N
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L2022000 N
L2023000 N
L2024100 N
L2025000 N
L2026100 N
L2027000 N
L2028000 N
L2029000 N
L2030000 N
L2031000 N
L2032000 N
L2033100 N
GOATFELL
SHA SOUTH
Mp-Cl
Mp-Au
Mp-Alr
Mp-Cm
Legend
VTEM - CVG Contours
(nT/m)
0.010
0.011 - 0.050
0.051 - 0.250
Mineral Occurrence
Tourmalinite
Albite Alterations
Fragmentals
Hematite Alteration
Digital Road Atlas
Rough or Loose Roads
Arterial Paved Roads
Highway paved
gD Fourier 2.67 Conformed
(mGal)
High : -117.75
Low : -135.876
N
0
500
1,000
1,500
Meters
Geology after Brown et al, 2011
Refer to GSC Open Files 6153 for legend

INTERPRETATION AND CONCLUSIONS

The geological evidence from exploration programs on the Goatfell property is permissive for sedex deposits within the Middle Aldridge or Lower Aldridge units. The drilling of four exploration holes by Chevron Minerals Ltd. and partners has not disproven the original theory that sedex mineralization could occur at the Sullivan time horizon within the property, as this unit has not yet been intersected in the drilling to date. However, a mineralizing event has been documented in the Middle Aldridge Formation on the adjacent Kid-Star property, where a sedex Pb-Zn-Ag deposit has been discovered. Strong geologic evidence suggests that this unit may be a more favorable and economically-attractive host. Recent work points to the onset of tectonic instability in the Goatfell area of the Creston structural corridor, occurring at "Kid" time, slightly later than the Sullivan time, and 2,400 feet above the level of the Sullivan deposit in the Sullivan Corridor.

Tourmalinite north of the area of 1995 drilling on the Goatfell property is evidence of the type of hydrothermal activity which could result in deposition of base metal sulphides. At the Sullivan orebody, base metal mineralization is concentrated along a north-south corridor and may be localized adjacent to the crosscutting Kimberley Fault.

At the Goatfell property, chlorite-pyrite-sericite alteration, tourmalinite and fragmentals are more strongly developed at the north end of the area of drilling, closer to the massive tourmalinite exposed on surface. This data generally supports a center of hydrothermal activity at the known surface tourmalinite occurrence. Additional drilling should be done to the north of the surface tourmalinite occurrence along the inferred hydrothermal corridor.

Results of the 2011 airborne surveys were encouraging as they identified a number of spatially coincident anomalies from multiple survey parameters. It remains unclear weather the spatially coincident magnetic gradient / gravity gradient anomalies are associated with a mapped Moyie Sill or possibly the down dip extension of the Spider Fault. A coincident magnetic high with gravity high could be explained by the presence of Iron Oxide (+/- Cu +/- Au) mineralization similar to what is observed at the adjacent Iron Range Fault, located 11km to the West.

RECOMMENDATIONS

Based on the favorable geological setting, property geology and alteration, the presence of anomalous base metals in rock and soil samples, and the results from the 2011 airborne geophysics survey, further work is recommended on the Goatfell Project as follows:

- Data compilation of all surficial and drill hole data, this would require a DGPS survey of existing infrastructure on the property;
- Additional prospecting and mapping of the tourmalinite alteration zones should be completed as there remains discrepancies between several different geological sources. Additional mapping of stratigraphic markers on the ridge south of the railway in the central part of the property is needed to provide stratigraphic correlations with those mapped on "Hazel Ridge";
- Geophysical techniques, both ground and airborne, have not proved useful on the property and should be used with caution in the future; that being said, post processing of the existing geophysical data by a third party geophysical consultant could result in new / revised target definition;
- Ground truthing of the coincident Mag CVG and gravity gradient anomaly is recommended to see if it can be explained on surface;
- Following the groundwork, several diamond drill-holes will be necessary to test for the presence of the "Kid-Star" horizon in Middle Aldridge sediments within the proposed zone of structural dislocation and basin-thickening.

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Appendix I

Certificate of Qualification

I, Christopher S. Gallagher of 616 Nelson Street, in the city of Kimberley in the Province of British Columbia hereby certify that:

1) I am currently employed as Manager of Exploration Technology for TerraLogic Exploration Inc. with a business address: Suite 200 44-12th Ave South, Cranbrook, BC, V1C2R7.

2) I am a graduate of the Carleton University with the degree of Master of Science in Geology (2001).

3) I have never applied for, nor committed conduct preventing designation within the Association of Professional Engineers and Geoscientists of British Columbia.

4) I am a graduate of Carleton University with the degree of Bachelor of Science in Geology (1997).

5) I have practised my profession in North America since 1999, having worked for various Junior Resource Companies and government surveys.

6) This report is based upon a personal examination of all available company and government reports pertinent to the Goatfell Property, located 20km east of Creston, BC.

7) For the writing of this report, the author has reviewed and accepts the quality and comprehensiveness of exploration data provided by GeoTech and Fugro Geophysical Surveys.

8) I own no Common Shares of 101191710 Saskatchewan Ltd. or 49 North Resources Inc.

9) I am an insider with Eagle Plains Resources Ltd since December 2004 and currently hold 0 shares and options to purchase 265,000 shares of the company at $0.25 - $1.00 per share.

Dated this 22nd day of February, 2012, in Cranbrook, British Columbia.

Christopher Gallagher, M. Sc.

TerraLogic Exploration Inc.

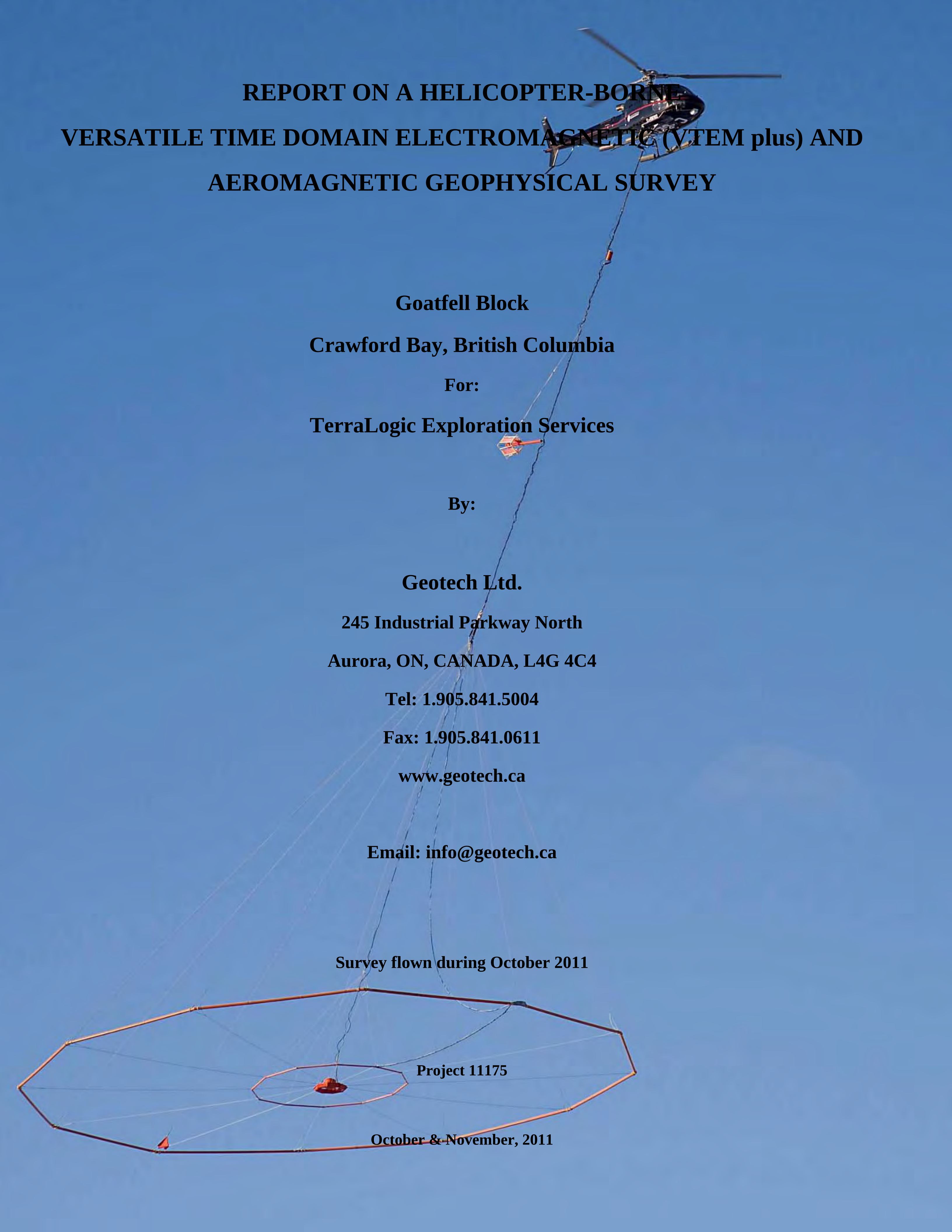
Appendix II

Statement of Expenditures

Statement of 2011 Expenditures					
Exploration Work type					**Totals**
TerraLogic Position	**Name**	**Days**	**Rate**	**Subtotal**	
Project Management	Christopher Gallagher, M. Sc.	2.9	$ 725.00	$ 2,124.25	
Project Management	Jim Ryley	0.4	$ 675.00	$ 249.75	
				$ 2,374.00	**$2,374.00**
Office Studies	**List Personnel**	**Days**	**Rate**	**Subtotal**	
Reporting	Chris Gallagher	0.5	$ 725.00	$ 362.50	
GIS / Data Management	Glen Hendrickson	0.25	$ 525.00	$ 131.25	
GIS / Data Management	Nathan Taylor	0.37	$ 360.00	$ 133.20	
				$ 626.95	**$626.95**
Consultants/Subcontractors					
GeoTech Airborne Geophysical Surveys	138.1 line km			$ 27,562.00	
Fugro Airborne Gravity Gradiometry	242.3 line km			$ 59,231.57	
				$ 86,793.57	**$86,793.57**
Geochemical Surveying	**Number of Samples**	**No.**	**Rate**	**Subtotal**	
Core Samples	3447 Samples			$ -	
Pulp Storage				$ -	
Petrophysical Analysis				$ -	
Whole Rock Analysis				$ -	
				$ -	**$0.00**
Transportation		**No.**	**Rate**	**Subtotal**	
Airfare				$ -	
Taxi				$ -	
truck rental				$ -	
kilometers				$ -	
ATV				$ -	
fuel				$ 3.84	
Helicopter (hours)	includes fuel			$ -	
Other	Passes, Tolls			$ -	
				$ 3.84	**$3.84**
Accommodation & Food	**Rates per day**				
Hotel				$ -	
Camp				0.00	
Meals				$ 5.82	
				$ 5.82	**$5.82**
Geological and Geochemical					
Petrographic analysis				$ -	
Map Plotting				$ -	
Sampling Consumables	sample bags, tags, flagging, etc...			$ -	
Standard Reference Materials				$ -	
				$ -	**$0.00**
Equipment Rentals					
Core Logging Facility				$ -	
Trailers				$ -	
XRF - Niton				$ -	
Sat Phone				$ -	
Hand Held Radios				$ -	
Chainsaw				$ -	
Hydraulic Splitter				$ -	
Computer and Printer				$ -	
Digital Camera				$ -	
Gun				$ -	
Survival Kit				$ -	
Level III First Aid Kit				$ -	
Other	Bearspray and bells			$ 203.60	
				$ 203.60	**$203.60**
Freight					
				$ -	**$0.00**
TerraLogic Exploration Handling and Adminstration Fees					
				$ 13,051.02	**$13,051.02**
TOTAL Expenditures					**$103,058.80**

Appendix III

Geotech Logistics Report



REPORT ON A HELICOPTER-BORNE VERSATILE TIME DOMAIN ELECTROMAGNETIC (VTEM plus) AND AEROMAGNETIC GEOPHYSICAL SURVEY

Goatfell Block

Crawford Bay, British Columbia

For:

TerraLogic Exploration Services

By:

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Survey flown during October 2011

Project 11175

October & November, 2011

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REPORT ON A HELICOPTER-BORNE
VERSATILE TIME DOMAIN ELECTROMAGNETIC (VTEM plus) and
AEROMAGNETIC SURVEY

Goatfell Block
Crawford Bay, British Columbia

Executive Summary

On October 19th, 2011 Geotech Ltd. carried out a helicopter-borne geophysical survey over the Goatfell block situated approximately 75 kilometres southeast of Crawford Bay, British Columbia and 15 kilometres east of Canyon, British Columbia.

Principal geophysical sensors included a versatile time domain electromagnetic (VTEM plus) system, and a caesium magnetometer. Ancillary equipment included a GPS navigation system and a radar altimeter. A total of 133.4 line-kilometres of geophysical data were acquired during the survey.

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 processed survey results are presented as the following maps:

- Electromagnetic stacked profiles of the B-field Z Component,
- Electromagnetic stacked profiles of dB/dt Z Components,
- Colour grids of a B-Field Z Component Channel,
- Total Magnetic Intensity (TMI), and
- EM Time-constant dB/dt Z Component (Tau), are presented.

Digital data includes all electromagnetic and magnetic products, plus ancillary data including the waveform.

The survey report describes the procedures for data acquisition, processing, final image presentation and the specifications for the digital data set.

1. INTRODUCTION

1.1 General Considerations

Geotech Ltd. performed a helicopter-borne geophysical survey over the Goatfell Block situated approximately 75 kilometres southeast of Crawford Bay, BC and 15 kilometres east of Canyon, BC (Figure 1 & Figure 2).

Chris Gallagher represented TerraLogic Exploration Services. during the data acquisition and data processing phases of this project.

The geophysical surveys consisted of helicopter borne EM using the versatile time-domain electromagnetic (VTEM plus) system with Z and X component measurements and aeromagnetics using a caesium magnetometer. A total of 133.4 line-km of geophysical data were acquired during the survey.

The crew was based out of Crawford Bay (Figure 2) in British Columbia for the acquisition phase of the survey. Survey flying for just the Goatfell Block started and finished on October 19th, 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 data processing followed immediately after the end of the survey. Final reporting, data presentation and archiving were completed from the Aurora office of Geotech Ltd. in October & November, 2011.

Figure 1 - Property Location

1.2 Survey and System Specifications

The Goatfell Block is located 15 kilometres east of Canyon, BC and approximately 75 kilometres southeast of Crawford Bay, British Columbia (Figure 2).

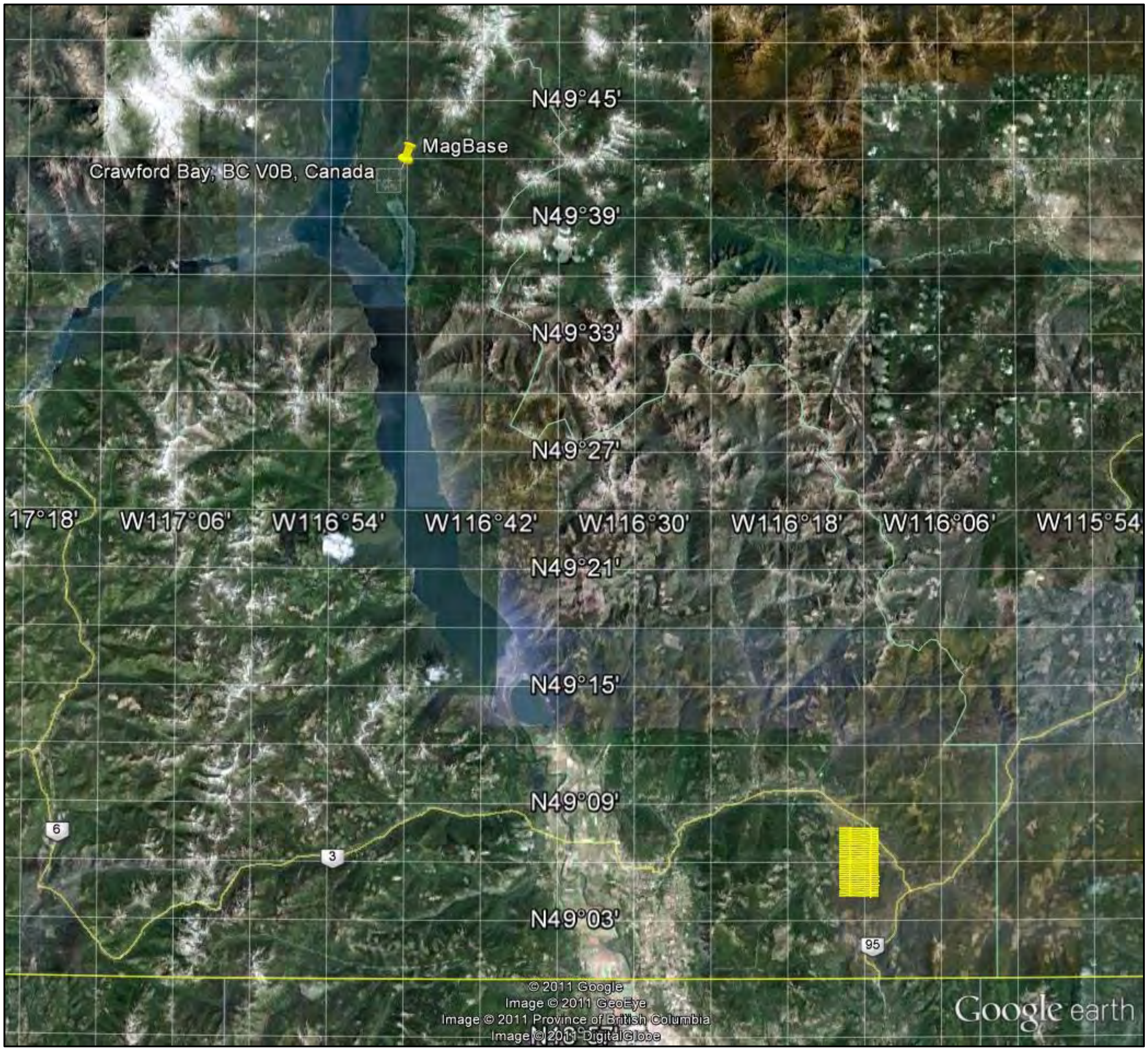

Figure 2 - Survey areas location on Google Earth

The survey block was flown in an east to west (N 90° E azimuth) direction, with traverse line spacing of 200 metres as depicted in Figure 3. Tie lines were flown perpendicular to the traverse lines (N 0° E azimuth) at a spacing of 2000 metres respectively. For more detailed information on the flight spacing and direction see Table 1.

1.3 Topographic Relief and Cultural Features

Topographically, the Goatfell Block exhibits a moderate to high relief with an elevation ranging from 773 to 1666 metres above mean sea level over an area of 26 square kilometres (Figure 3).

The survey block has various rivers and streams running through the survey area which connect various lakes and wetlands. There are visible signs of culture due to the proximity to the two towns of Canyon and Lister which can be seen just fifteen kilometres west of the survey. There are various railways, pipelines and roads running through the northeast corner of the survey. There are also a large number of roads scattered throughout the survey area.

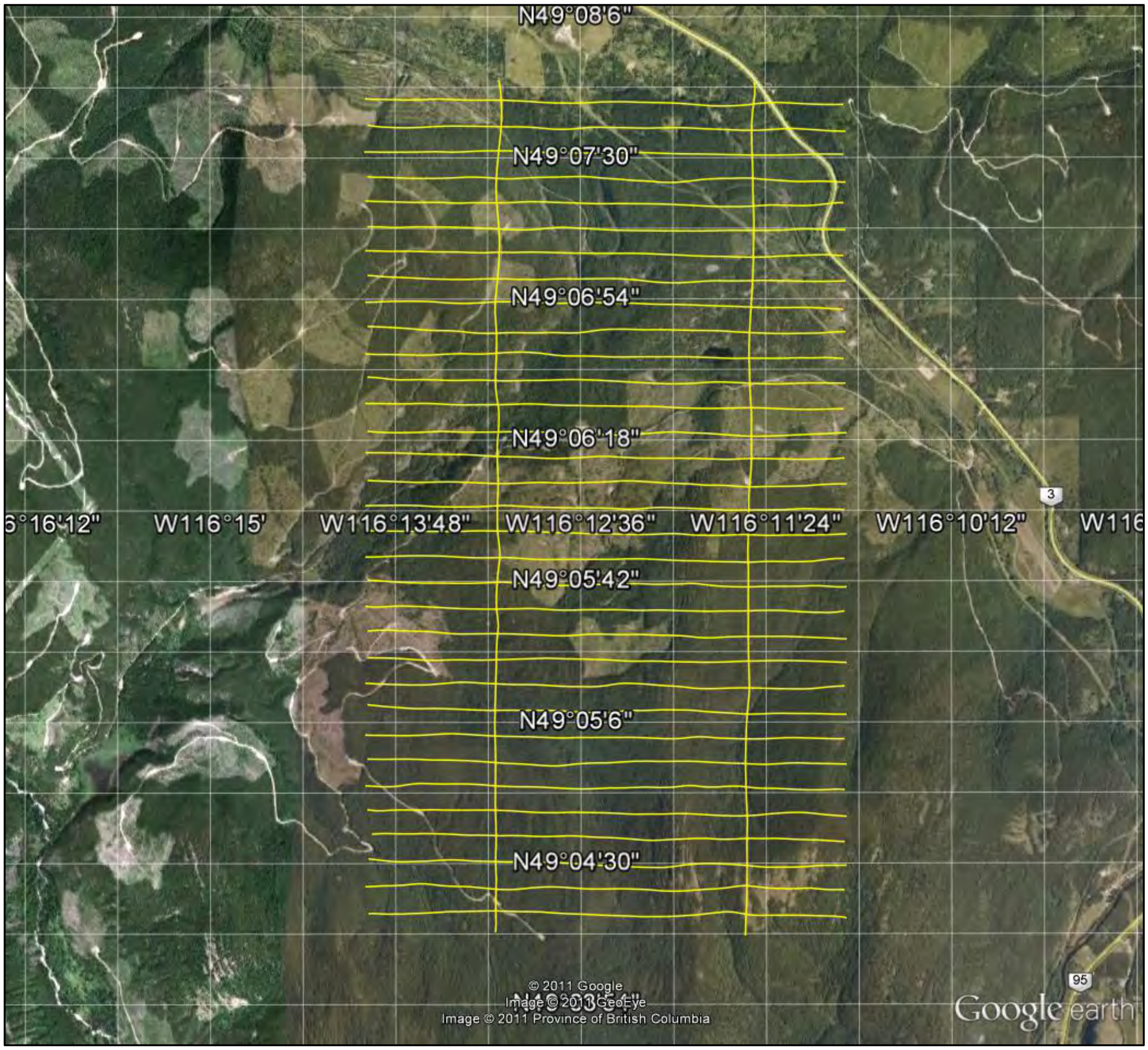

Figure 3 - Flight path over a Google Earth Image – Goatfell Block

The survey area is covered by NTS (National Topographic Survey) of the Canada sheet 082F01.

2. DATA ACQUISITION

2.1 Survey Area

The survey block (see Figure 3 and Appendix A) and general flight specifications are as follows:

Table 1 - Survey Specifications

Survey block	Traverse Line spacing (m)	Area (Km^2)	Planned[1] Line-km	Actual Line-km	Flight direction	Line numbers
Goatfell Block	Traverse: 200	26	133.4	124.6	N 90° E / N 270° E	L5000 – L5320
	Tie: 2000			13.5	N 0° E / N 180° E	T5800 – T5810
TOTAL		26	133.4	138.1		

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

2.2 Survey Operations

Survey operations were based out of Crawford Bay, British Columbia on October 19th, 2011. The following table shows the timing of the flying.

Table 2 - Survey schedule

Date	Flight #	Flown km	Block	Crew location	Comments
Oct-19-2011	22,23	133	EPL2	Crawford Bay, BC	133km flown – survey stopped as per client

[1] Note: Actual Line kilometres represent the total line kilometres in the final database. These line-km normally exceed the Planned line-km, as indicated in the survey NAV files.

2.3 Flight Specifications

During the survey the helicopter was maintained at a mean altitude of 117 metres above the ground with a nominal survey speed of 80 km/hour. This allowed for a nominal EM bird terrain clearance of 84 metres and a magnetic sensor clearance of 104 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 features.

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 qualified personnel.

2.4 Aircraft and Equipment

2.4.1 Survey Aircraft

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

2.4.2 Electromagnetic System

The electromagnetic system was a Geotech Time Domain EM (VTEM plus) system. The configuration is as indicated in Figure 4.

The VTEM plus Receiver and transmitter coils were in concentric-coplanar and Z-direction oriented configuration. The receiver system for the project also included a coincident-coaxial X-direction coil to measure the in-line dB/dt and calculate B-Field responses. The EM bird was towed at a mean distance of 35 metres below the aircraft as shown in Figure 4 and . The receiver decay recording scheme is shown in Figure 5.

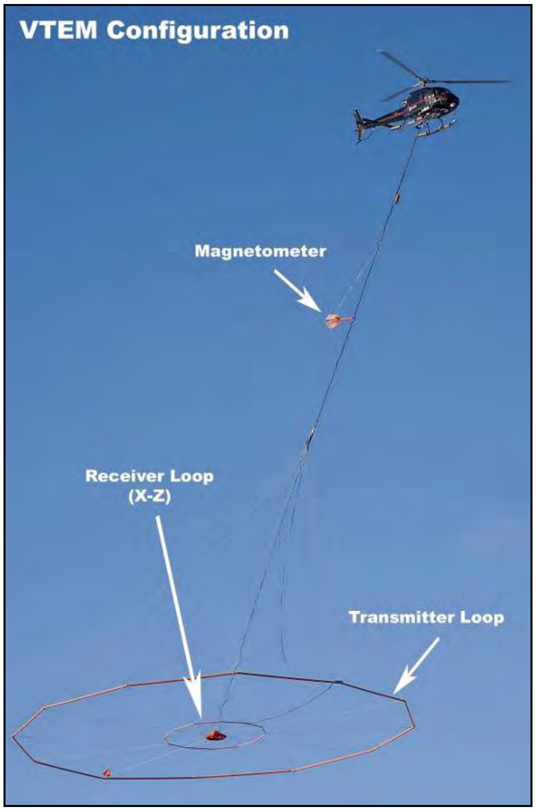

Figure 4 - VTEM plus Configuration, with magnetometer.

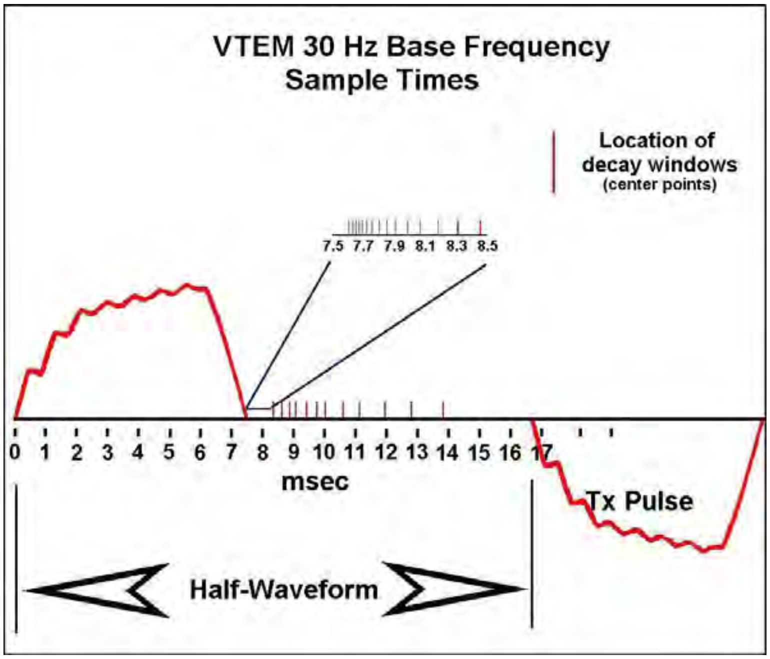

Figure 5 - VTEM plus Waveform & Sample Times

The VTEM plus decay sampling scheme is shown in Table 3 below. Thirty-two time measurement gates were used for the final data processing in the range from 96 to 7036 μ sec.

Table 3 - Decay Sampling Scheme

VTEM plus Decay Sampling Scheme				
Index	Middle	Start	End	Window
	Microseconds			
14	96	90	103	13
15	110	103	118	15
16	126	118	136	18
17	145	136	156	20
18	167	156	179	23
19	192	179	206	27
20	220	206	236	30
21	253	236	271	35
22	290	271	312	40
23	333	312	358	46
24	383	358	411	53
25	440	411	472	61
26	505	472	543	70
27	580	543	623	81
28	667	623	716	93
29	766	716	823	107
30	880	823	945	122
31	1,010	945	1,086	141
32	1,161	1,086	1,247	161
33	1,333	1,247	1,432	185
34	1,531	1,432	1,646	214
35	1,760	1,646	1,891	245
36	2,021	1,891	2,172	281
37	2,323	2,172	2,495	323
38	2,667	2,495	2,865	370
39	3,063	2,865	3,292	427
40	3,521	3,292	3,781	490
41	4,042	3,781	4,341	560
42	4,641	4,341	4,987	646
43	5,333	4,987	5,729	742
44	6,125	5,729	6,581	852
45	7,036	6,581	7,560	979

VTEM plus system parameters:

<u>Transmitter Section</u>

- Transmitter coil diameter: 26 m
- Number of turns: 4
- Transmitter base frequency: 30 Hz
- Peak current: 160 A
- Pulse width: 7.14 ms
- Duty cycle: 43 %
- Wave form shape: trapezoid
- Peak dipole moment: 339,794 nIA
- Nominal EM Bird terrain clearance: 84 metres above the ground
- Effective coil area: 2123 m^2

<u>Receiver Section</u>

<u>X-Coil</u>

- X Coil diameter: 0.32 m
- Number of turns: 245
- Effective coil area: 19.69 m^2

<u>Z-Coil</u>

- Z-Coil coil diameter: 1.2 m
- Number of turns: 100
- Effective coil area: 113.04 m^2

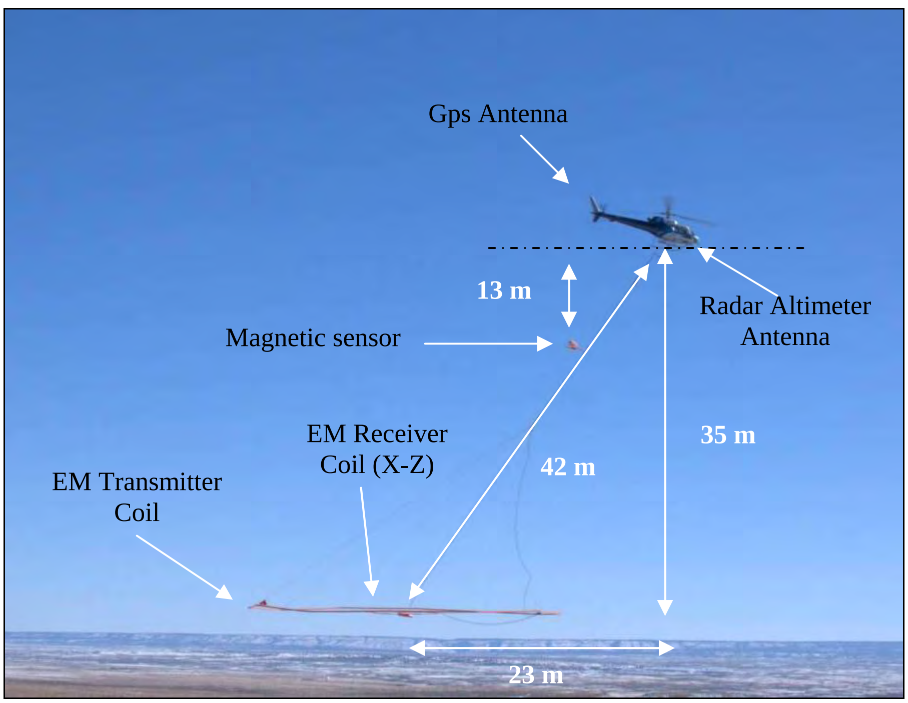

Figure 6 - VTEM plus System Configuration

2.4.3 Airborne magnetometer

The magnetic sensor utilized for the survey was Geometrics optically pumped caesium vapour magnetic field sensor mounted 13 metres below the helicopter, as shown in Figure 6. The sensitivity of the magnetic sensor is 0.02 nanoTesla (nT) at a sampling interval of 0.1 seconds.

2.4.4 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 (Figure 6).

2.4.5 GPS Navigation System

The navigation system used was a Geotech PC104 based navigation system utilizing a NovAtel's CDGPS (Canada-Wide Differential Global Positioning System Correction Service) enable OEM4-G2-3151W GPS receiver, Geotech navigate software, a full screen display with controls in front of the pilot to direct the flight and an NovAtel GPS antenna mounted on the helicopter tail (Figure 6). As many as 11 GPS and two CDGPS satellites may be monitored at any one time. The positional accuracy or circular error probability (CEP) is 1.8 m, with CDGPS active, it is 1.0 m. The co-ordinates of the block were set-up prior to the survey and the information was fed into the airborne navigation system.

2.4.6 Digital Acquisition System

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 4.

Table 4 - Acquisition Sampling Rates

DATA TYPE	SAMPLING
TDEM	0.1 sec
Magnetometer	0.1 sec
GPS Position	0.2 sec
Radar Altimeter	0.2 sec

2.5 Base Station

A combined magnetometer/GPS base station was utilized on this project. A Geometrics Caesium 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 sensor was installed North of the Kokanee Springs Driving Range (116°48'27.006"W, 49°41'22.88"N); 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.

Field:

Project Manager:	Darren Tuck (Office)
Data QC:	Neil Fiset (Office)
Crew chief:	Roger LeBlanc
Operator:	John West-Fiset

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

Pilot:	Brook Pennington
Mechanical Engineer:	n/a

Office:

Preliminary Data Processing:	Neil Fiset
Final Data Processing:	Keeme Mokubung/Shaolin Lu
Final Data QA/QC:	Alexander Prikhodko
Reporting/Mapping:	Corrie Laver

Data acquisition phase was carried out under the supervision of Andrei Bagrianski, P. Geo, Chief Operating Officer. The processing and interpretation phase was under the supervision of Alexander Prikhodko, P. Geo. The customer relations were looked after by Blair Walker.

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 Datum, UTM Zone 11 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 Electromagnetic Data

A three stage digital filtering process was used to reject major sferic events and to reduce system noise. Local sferic activity can produce sharp, large amplitude events that cannot be removed by conventional filtering procedures. Smoothing or stacking will reduce their amplitude but leave a broader residual response that can be confused with geological phenomena. To avoid this possibility, a computer algorithm searches out and rejects the major sferic events.

The signal to noise ratio was further improved by the application of a low pass linear digital filter. This filter has zero phase shift which prevents any lag or peak displacement from occurring, and it suppresses only variations with a wavelength less than about 1 second or 15 metres. This filter is a symmetrical 1 sec linear filter.

The results are presented as stacked profiles of EM voltages for the time gates, in linear - logarithmic scale for the B-field Z component and dB/dt responses in the Z and X components. B-field Z component time channel recorded at 2.021 milliseconds after the termination of the impulse is also presented as contour colour images. Fraser Filter X component is also presented as a colour image. Calculated Time Constant (TAU) with anomaly contours of Calculated Vertical Derivative of TMI is presented in Appendix D and F. Resistivity Depth Image (RDI) is also presented in Appendix D and G.

VTEM plus has two receiver coil orientations. Z-axis coil is oriented parallel to the transmitter coil axis and both are horizontal to the ground. The X-axis coil is oriented parallel to the ground and along the line-of-flight. This combined two coil configuration provides information on the position, depth, dip and thickness of a conductor. Generalized modeling results of VTEM plus data are shown in Appendix E.

In general X-component data produce cross-over type anomalies: from "+ to – "in flight direction of flight for "thin" sub vertical targets and from "- to +" in direction of flight for "thick" targets. Z component data produce double peak type anomalies for "thin" sub vertical targets and single peak for "thick" targets.

The limits and change-over of “thin-thick” depends on dimensions of a TEM system.

Because of X component polarity is under line-of-flight, convolution Fraser filter (FF, Figure 7) is applied to X component data to represent axes of conductors in the form of grid map. In this case positive FF anomalies always correspond to “plus-to-minus” X data crossovers independently of direction of flight.

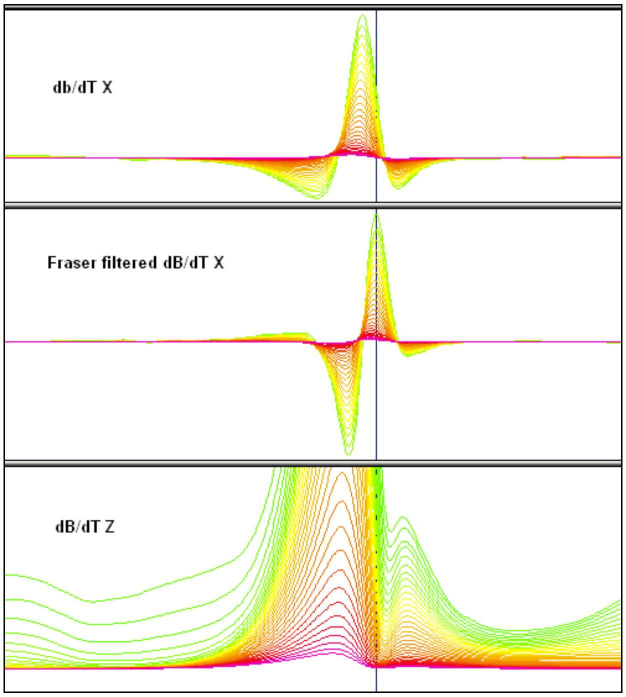

Figure 7 - Z, X and Fraser filtered X (FFx) components for “thin” target

Graphical representations of the VTEM plus transmitter input current and the output voltage of the receiver coil are shown in Appendix C.

4.3 Magnetic Data

The processing of the magnetic 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 approximately 50 metres at the mapping scale. 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 a scale of 1:20,000 for best representation of the survey size and line spacing. The coordinate/projection system used was NAD83 Datum, UTM Zone 11 North. All maps show the mining claims, 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 EM profiles, a late-time gate gridded EM channel, and a color magnetic TMI contour map. The following maps are presented on paper;

- VTEM dB/dt profiles Z Component, Time Gates 0.220 – 7.036 ms in linear – logarithmic scale.
- VTEM B-Field profiles Z Component, Time Gates 0.220 – 7.036 ms in linear – logarithmic scale.
- VTEM B-field late time Z Component Channel 36, Time Gate 2.021 ms colour image.
- VTEM dB/dt Calculated Time Constant (TAU) with contours of anomaly areas of the Calculated Vertical Derivative of TMI
- Total Magnetic Intensity (TMI) colour image and contours.

5.3 Digital Data

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

- DVD structure.

Data	contains databases, grids and maps, 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 5.

Table 5 - Geosoft GDB Data Format

Channel name	Units	Description
X:	metres	UTM Easting NAD83 Zone 11 North
Y:	metres	UTM Northing NAD83 Zone 11 North
Z:	metres	GPS antenna elevation (above Geoid)
Longitude:	Decimal Degrees	WGS 84 Longitude data
Latitude:	Decimal Degrees	WGS 84 Latitude data
Radar:	metres	helicopter terrain clearance from radar altimeter
Radarb:	metres	Calculated EM bird terrain clearance from radar altimeter
DEM:	metres	Digital Elevation Model
Gtime:	Seconds of the day	GPS time
Mag1:	nT	Raw Total Magnetic field data
Basemag:	nT	Magnetic diurnal variation data
Mag2:	nT	Diurnal corrected Total Magnetic field data
Mag3:	nT	Levelled Total Magnetic field data
CVG	nT	Calculated Vertical Derivative of TMI
SFz[14]:	$pV/(A*m^4)$	Z dB/dt 96 microsecond time channel
SFz[15]:	$pV/(A*m^4)$	Z dB/dt 110 microsecond time channel
SFz[16]:	$pV/(A*m^4)$	Z dB/dt 126 microsecond time channel
SFz[17]:	$pV/(A*m^4)$	Z dB/dt 145 microsecond time channel
SFz[18]:	$pV/(A*m^4)$	Z dB/dt 167 microsecond time channel
SFz[19]:	$pV/(A*m^4)$	Z dB/dt 192 microsecond time channel
SFz[20]:	$pV/(A*m^4)$	Z dB/dt 220 microsecond time channel
SFz[21]:	$pV/(A*m^4)$	Z dB/dt 253 microsecond time channel
SFz[22]:	$pV/(A*m^4)$	Z dB/dt 290 microsecond time channel
SFz[23]:	$pV/(A*m^4)$	Z dB/dt 333 microsecond time channel
SFz[24]:	$pV/(A*m^4)$	Z dB/dt 383 microsecond time channel
SFz[25]:	$pV/(A*m^4)$	Z dB/dt 440 microsecond time channel
SFz[26]:	$pV/(A*m^4)$	Z dB/dt 505 microsecond time channel
SFz[27]:	$pV/(A*m^4)$	Z dB/dt 580 microsecond time channel
SFz[28]:	$pV/(A*m^4)$	Z dB/dt 667 microsecond time channel
SFz[29]:	$pV/(A*m^4)$	Z dB/dt 766 microsecond time channel
SFz[30]:	$pV/(A*m^4)$	Z dB/dt 880 microsecond time channel
SFz[31]:	$pV/(A*m^4)$	Z dB/dt 1010 microsecond time channel
SFz[32]:	$pV/(A*m^4)$	Z dB/dt 1161 microsecond time channel
SFz[33]:	$pV/(A*m^4)$	Z dB/dt 1333 microsecond time channel
SFz[34]:	$pV/(A*m^4)$	Z dB/dt 1531 microsecond time channel
SFz[35]:	$pV/(A*m^4)$	Z dB/dt 1760 microsecond time channel
SFz[36]:	$pV/(A*m^4)$	Z dB/dt 2021 microsecond time channel
SFz[37]:	$pV/(A*m^4)$	Z dB/dt 2323 microsecond time channel
SFz[38]:	$pV/(A*m^4)$	Z dB/dt 2667 microsecond time channel
SFz[39]:	$pV/(A*m^4)$	Z dB/dt 3063 microsecond time channel
SFz[40]:	$pV/(A*m^4)$	Z dB/dt 3521 microsecond time channel
SFz[41]:	$pV/(A*m^4)$	Z dB/dt 4042 microsecond time channel
SFz[42]:	$pV/(A*m^4)$	Z dB/dt 4641 microsecond time channel
SFz[43]:	$pV/(A*m^4)$	Z dB/dt 5333 microsecond time channel
SFz[44]:	$pV/(A*m^4)$	Z dB/dt 6125 microsecond time channel
SFz[45]:	$pV/(A*m^4)$	Z dB/dt 7036 microsecond time channel
SFx[20]:	$pV/(A*m^4)$	X dB/dt 220 microsecond time channel
SFx[21]:	$pV/(A*m^4)$	X dB/dt 253 microsecond time channel
SFx[22]:	$pV/(A*m^4)$	X dB/dt 290 microsecond time channel
SFx[23]:	$pV/(A*m^4)$	X dB/dt 333 microsecond time channel

Channel name	Units	Description
SFx[24]:	pV/(A*m^4)	X dB/dt 383 microsecond time channel
SFx[25]:	pV/(A*m^4)	X dB/dt 440 microsecond time channel
SFx[26]:	pV/(A*m^4)	X dB/dt 505 microsecond time channel
SFx[27]:	pV/(A*m^4)	X dB/dt 580 microsecond time channel
SFx[28]:	pV/(A*m^4)	X dB/dt 667 microsecond time channel
SFx[29]:	pV/(A*m^4)	X dB/dt 766 microsecond time channel
SFx[30]:	pV/(A*m^4)	X dB/dt 880 microsecond time channel
SFx[31]:	pV/(A*m^4)	X dB/dt 1010 microsecond time channel
SFx[32]:	pV/(A*m^4)	X dB/dt 1161 microsecond time channel
SFx[33]:	pV/(A*m^4)	X dB/dt 1333 microsecond time channel
SFx[34]:	pV/(A*m^4)	X dB/dt 1531 microsecond time channel
SFx[35]:	pV/(A*m^4)	X dB/dt 1760 microsecond time channel
SFx[36]:	pV/(A*m^4)	X dB/dt 2021 microsecond time channel
SFx[37]:	pV/(A*m^4)	X dB/dt 2323 microsecond time channel
SFx[38]:	pV/(A*m^4)	X dB/dt 2667 microsecond time channel
SFx[39]:	pV/(A*m^4)	X dB/dt 3063 microsecond time channel
SFx[40]:	pV/(A*m^4)	X dB/dt 3521 microsecond time channel
SFx[41]:	pV/(A*m^4)	X dB/dt 4042 microsecond time channel
SFx[42]:	pV/(A*m^4)	X dB/dt 4641 microsecond time channel
SFx[43]:	pV/(A*m^4)	X dB/dt 5333 microsecond time channel
SFx[44]:	pV/(A*m^4)	X dB/dt 6125 microsecond time channel
SFx[45]:	pV/(A*m^4)	X dB/dt 7036 microsecond time channel
BFz	(pV*ms)/(A*m4)	Z B-Field data for time channels 14 to 45
BFx	(pV*ms)/(A*m4)	X B-Field data for time channels 20 to 45
SFxFF	pV/(A*m4)	Fraser filtered X dB/dt
PLM:		60 Hz power line monitor
TauSF1	milliseconds	Time Constant (Tau) calculated from dB/dt data
TauBF1	milliseconds	Time Constant (Tau) calculated from B-Field data

Electromagnetic B-field and dB/dt Z component data is found in array channel format between indexes 14 – 45, and X component data from 20 – 45, as described above.

- Database of the VTEM Waveform "11175_waveform_final.gdb" in Geosoft GDB format, containing the following channels:

Time:	Sampling rate interval, 5.2083 microseconds
Rx_Volt:	Output voltage of the receiver coil (Volt)
Tx_Current:	Output current of the transmitter (Amp)

- Grids in Geosoft GRD format, as follows:

BFz36:	B-Field Z Component Channel 36 (Time Gate 2.021 ms)
TMI:	Total Magnetic Intensity (nT)
CVG:	Calculated Vertical Derivative of TMI (nT/m)
TauSF:	dB/dt Calculated Time Constant (ms)
SFxFF20:	Fraser Filter X Component dB/dt Channel 20 (Time Gate 0.220 ms)
DEM:	Digital Elevation Model (metres)
PLM:	Power Line Monitor (60Hz)

A Geosoft .GRD file has a .GI metadata file associated with it, containing grid projection information. A grid cell size of 50 metres was used.

- Maps at 1:20,000 in Geosoft MAP format, as follows:

11175_ 20k _dBdtz_*bb*:	dB/dt profiles Z Component, Time Gates 0.220 – 7.036 ms in linear – logarithmic scale.
11175_ 20k _Bfield_*bb*:	B-field profiles Z Component, Time Gates 0.220 – 7.036 ms in linear – logarithmic scale over total magnetic intensity.
11175_ 20k_BFz36_*bb*:	B-field late time Z Component Channel 36, Time Gate 2.021 ms color image.
11175_ 20k_SFxFF20_*bb*:	dB/dt early time X Component Fraser Filter Channel 20, Time Gate 0.220 ms color image.
11175_ 20k_TMI_*bb*:	Total magnetic intensity (TMI) color image and contours.
11175_ 20k_PLM_*bb*:	Powerline Monitor
11175_ 20k_TauSF_*bb*:	dB/dt Calculated Time Constant (TAU) with contours of anomaly areas of the Calculated Vertical Derivative of TMI

Where *bb* represents the block name (ie. 11175_20k_TMI_Goatfell)

Maps are also presented in PDF format.

1:250,000 topographic vectors were taken from the NRCAN Geogratis database at; http://geogratis.gc.ca/geogratis/en/index.html.

- A Google Earth file *11175_Goatfell.kml* showing the flight path of the block is included. Free versions of Google Earth software from: http://earth.google.com/download-earth.html

6. CONCLUSIONS AND RECOMMENDATIONS

A helicopter-borne versatile time domain electromagnetic (VTEM plus) geophysical survey has been completed over the Goatfell Block near Crawford Bay, British Columbia.

The total area coverage is 26 km^2. Total survey line coverage is 138.1 line kilometres. The principal sensors included a Time Domain EM system and a magnetometer. Results have been presented as stacked profiles, and contour color images at a scale of 1:20,000.

Based on the geophysical results obtained, the area does not have anomalous conductive zones. In Figure , the zone marked as #1 is possibly train tracks and zone #2 are powerlines.

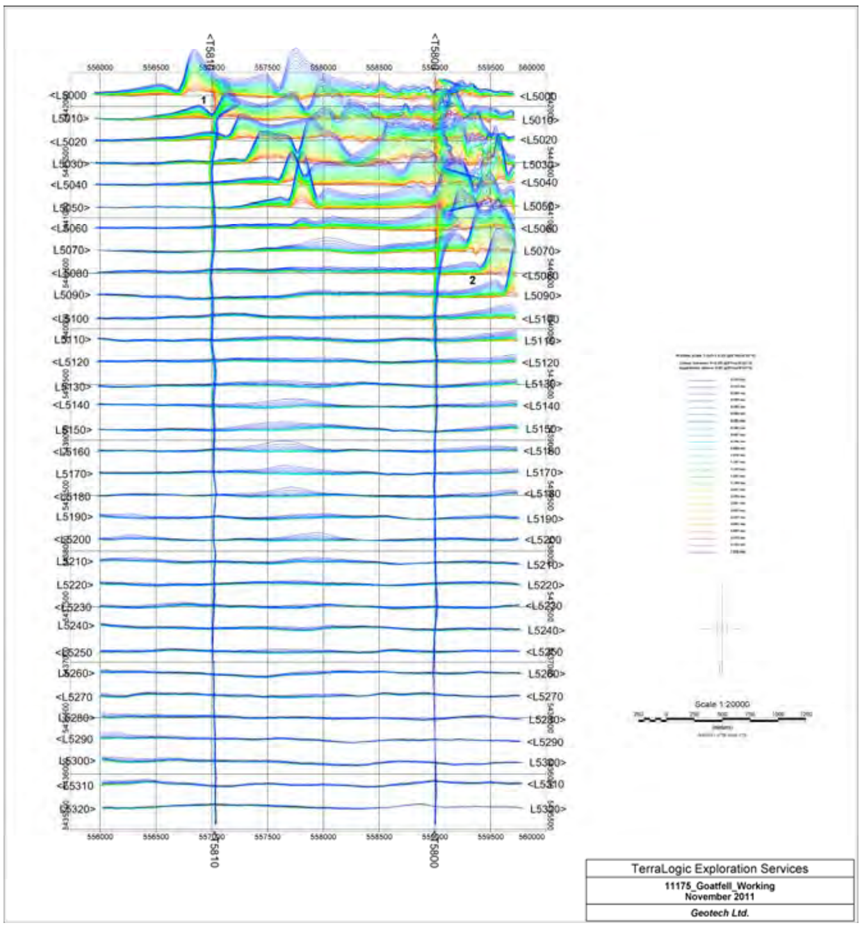

Figure 8: 11175 Goatfell profiles showing EM responses

Respectfully submitted[5],

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Geotech Ltd.

Alexander Prikhodko, P.Geo.
Geotech Ltd.

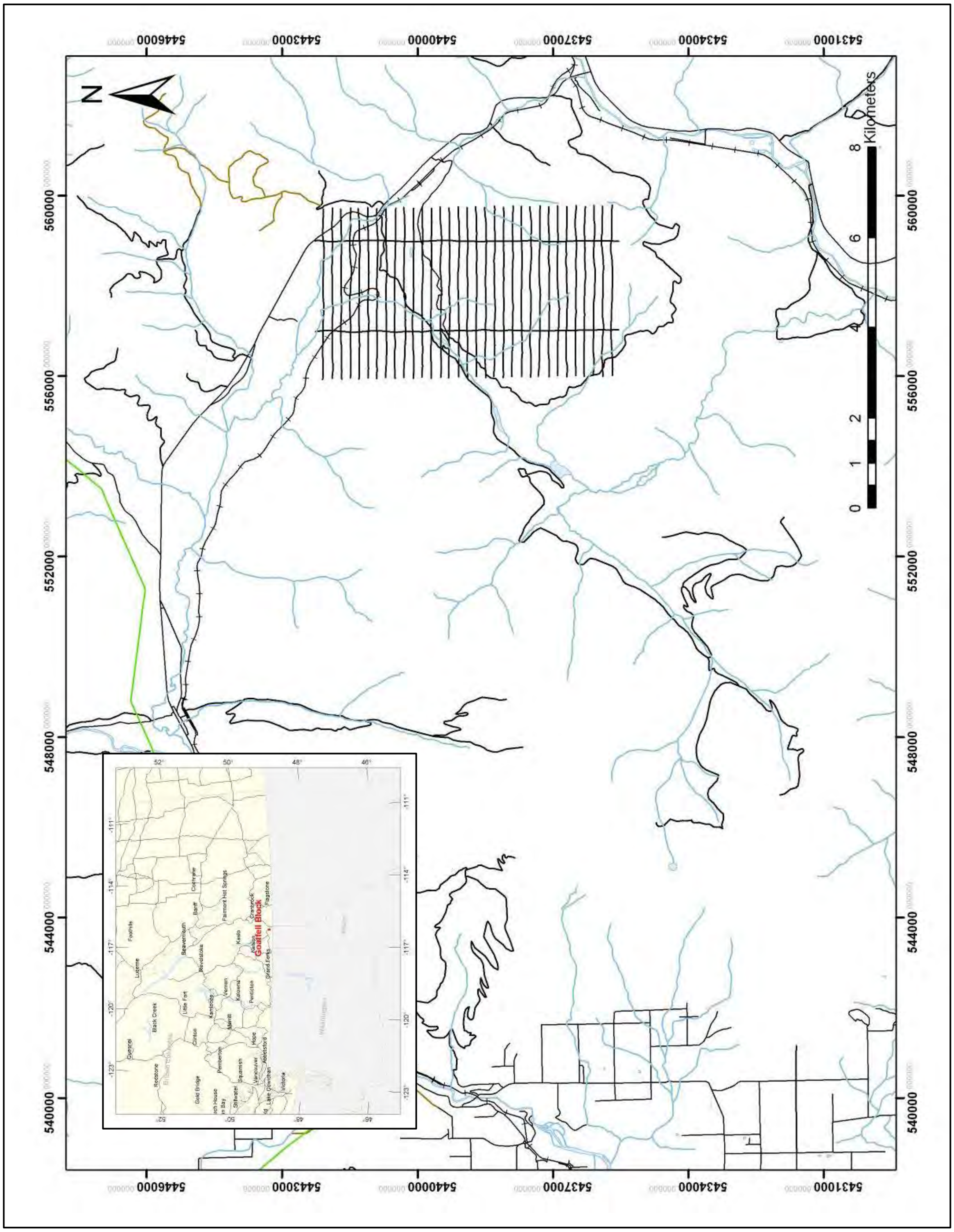
Keeme Mokubung
Geotech Ltd.

November 2011

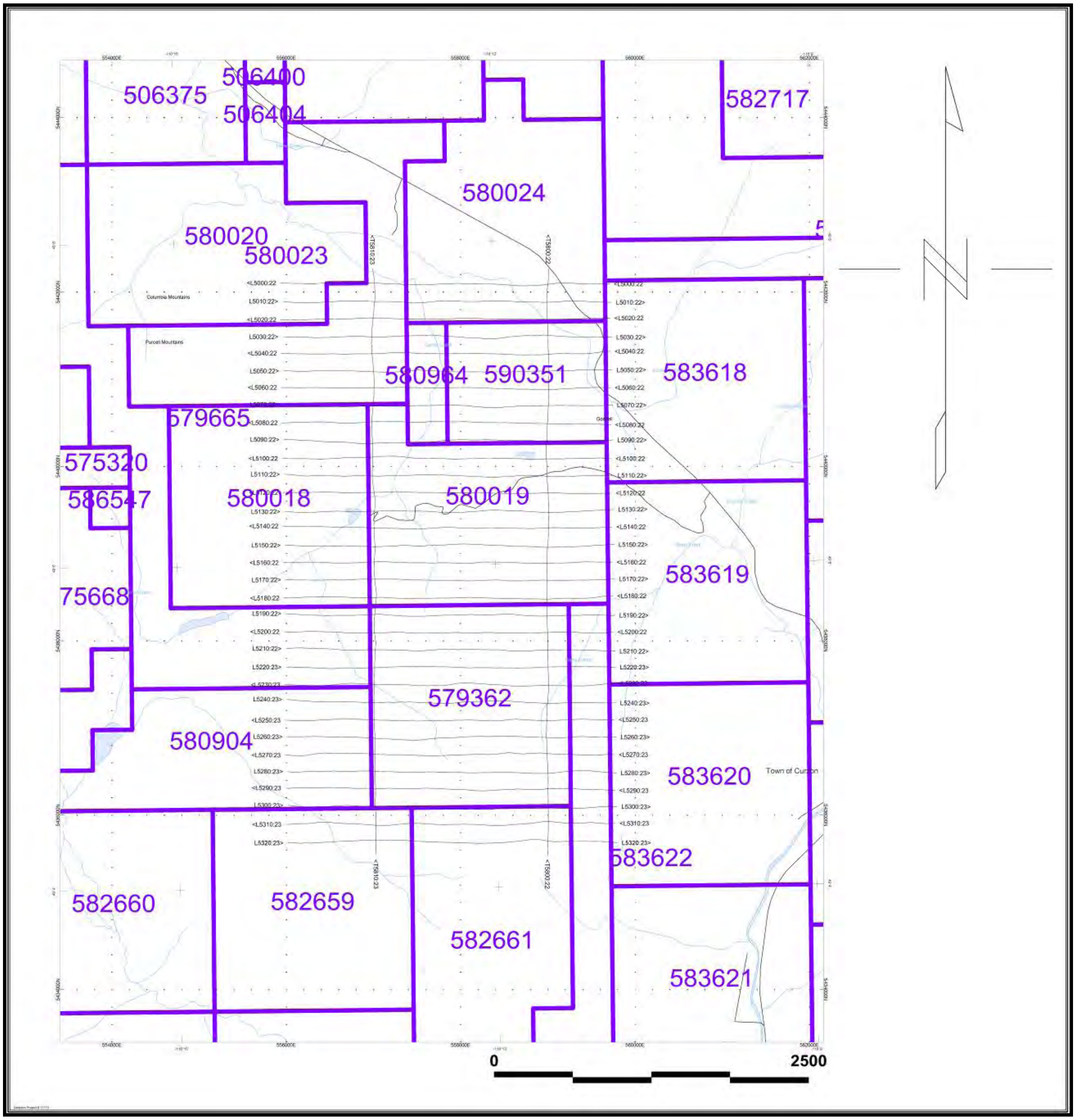
[5]Final data processing of the EM and magnetic data were carried out by Keeme Mokubung & Shaolin Lu, from the office of Geotech Ltd. in Aurora, Ontario, under the supervision of Alexander Prikhodko, P.Geo., PhD, Senior Geophysicist, VTEM Interpretation Supervisor.

APPENDIX A

SURVEY BLOCK LOCATION MAP



Survey Overview of the Blocks



Mining Claims

APPENDIX B

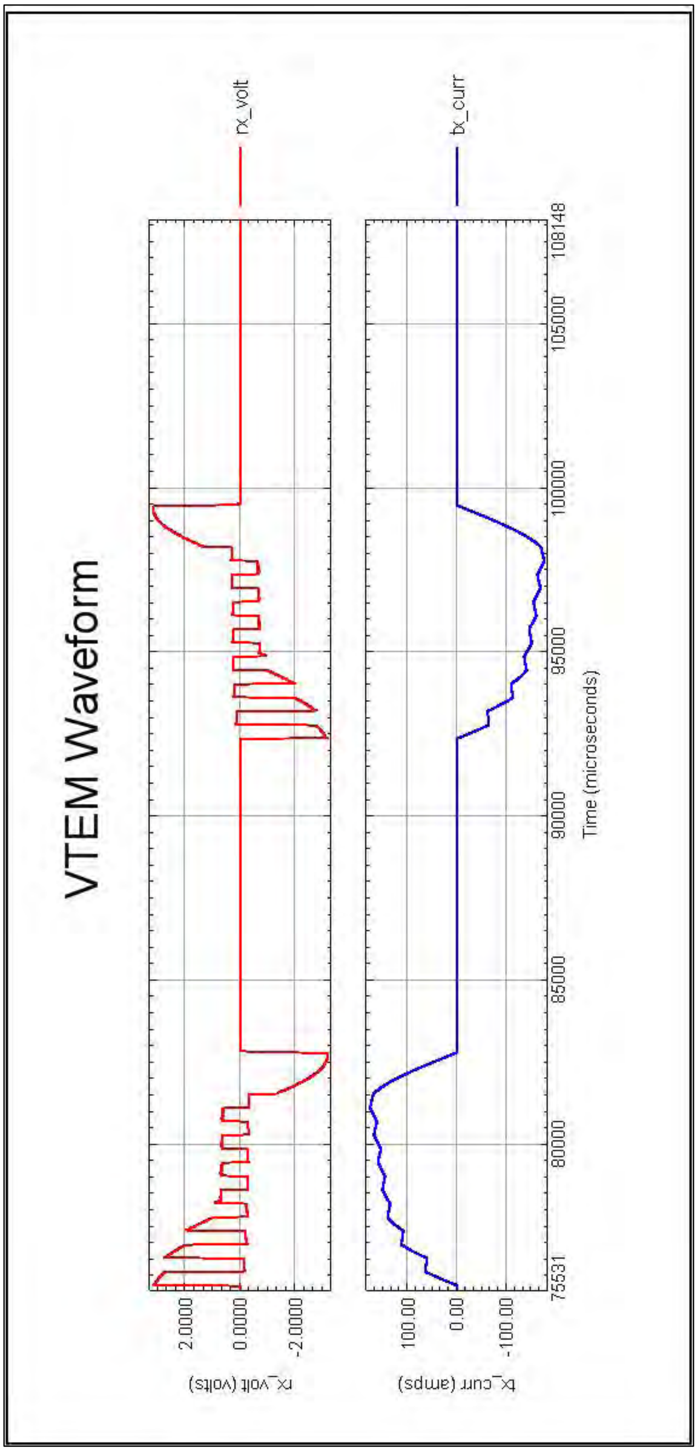
SURVEY BLOCK COORDINATES

(WGS 84, UTM Zone 11 North)

X	Y
559654.1	5442131
556006.4	5442093
556072.3	5435608
559724.3	5435647

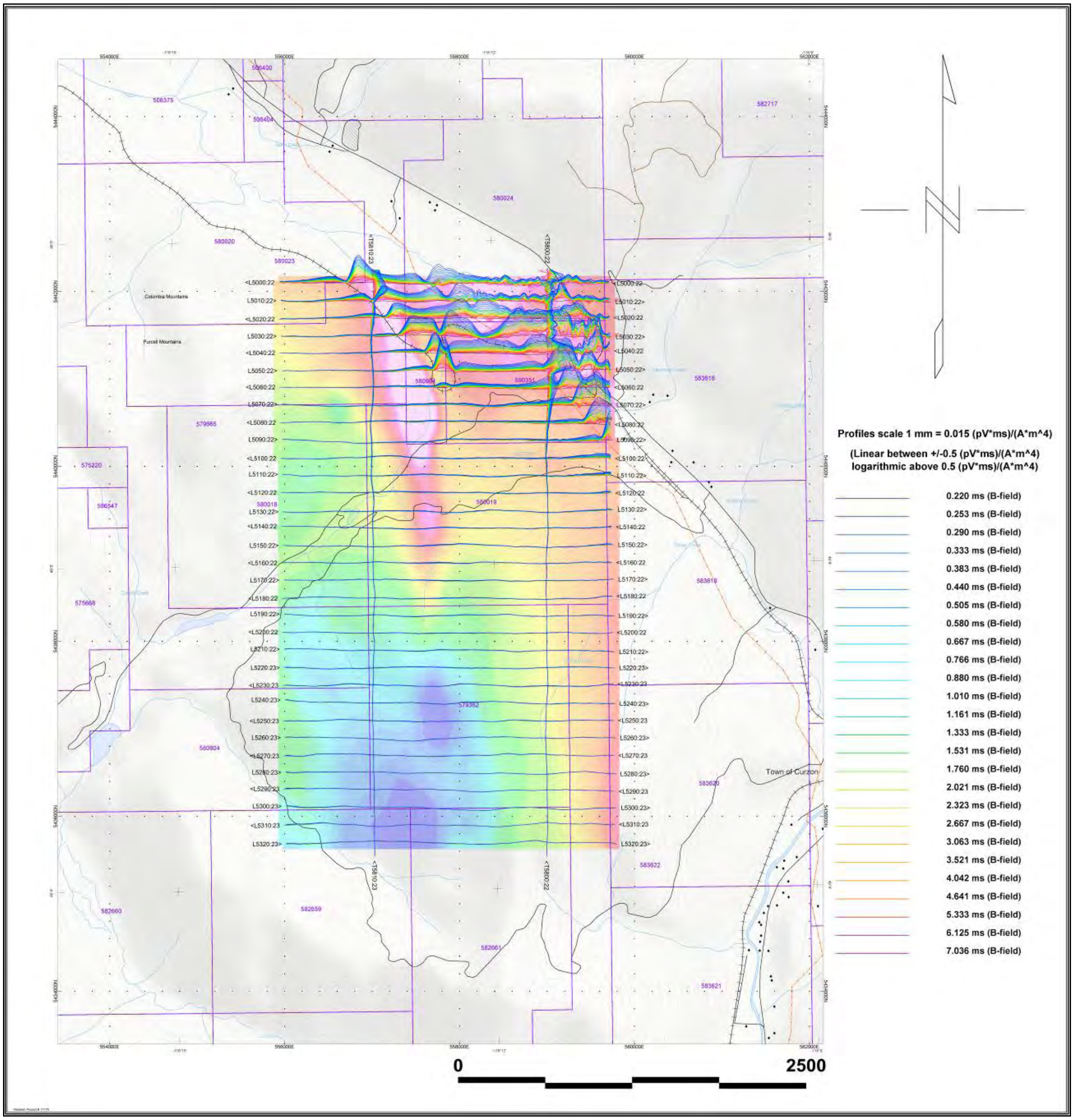
APPENDIX C

VTEM WAVEFORM



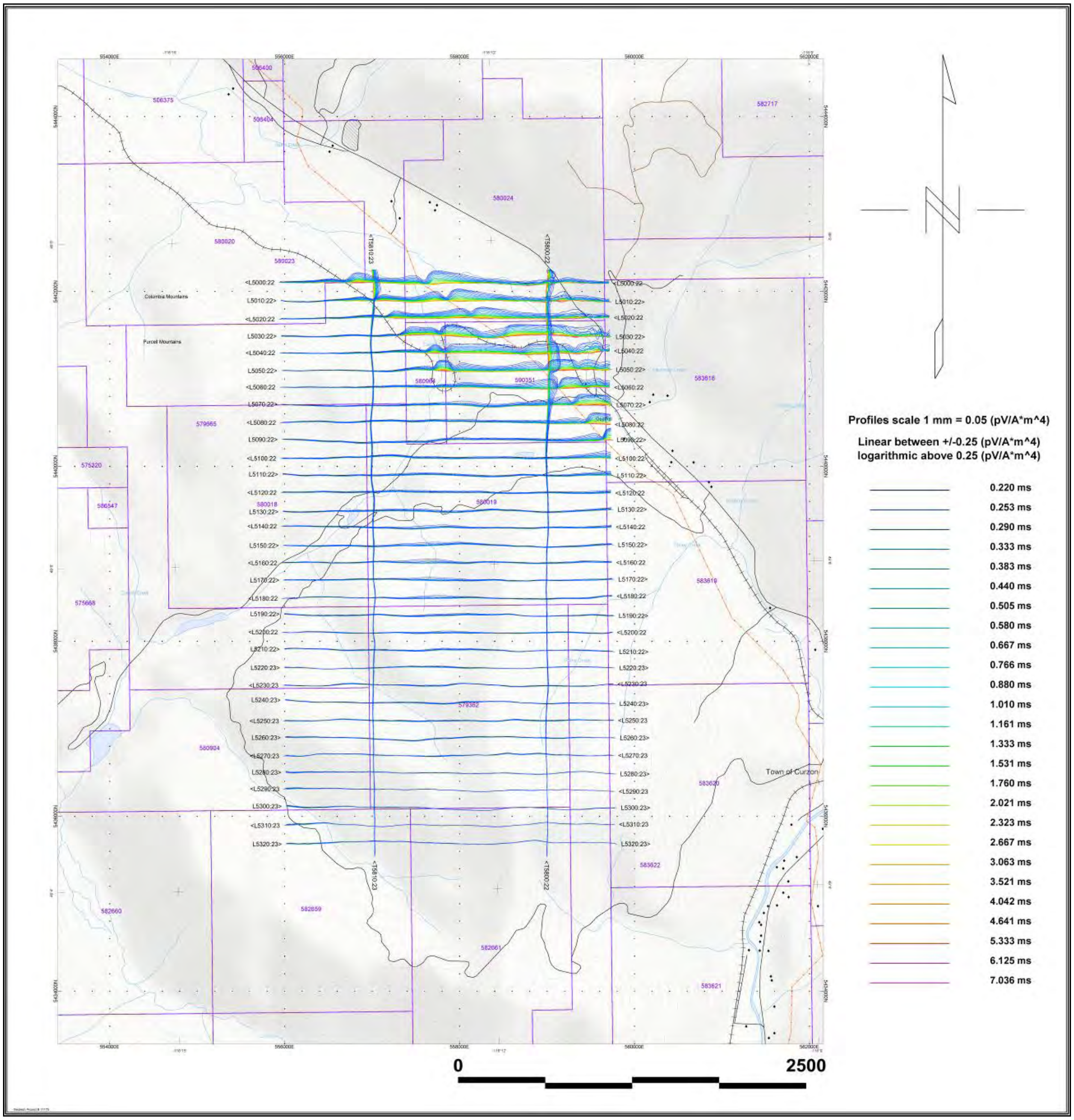
APPENDIX D

GEOPHYSICAL MAPS[1]

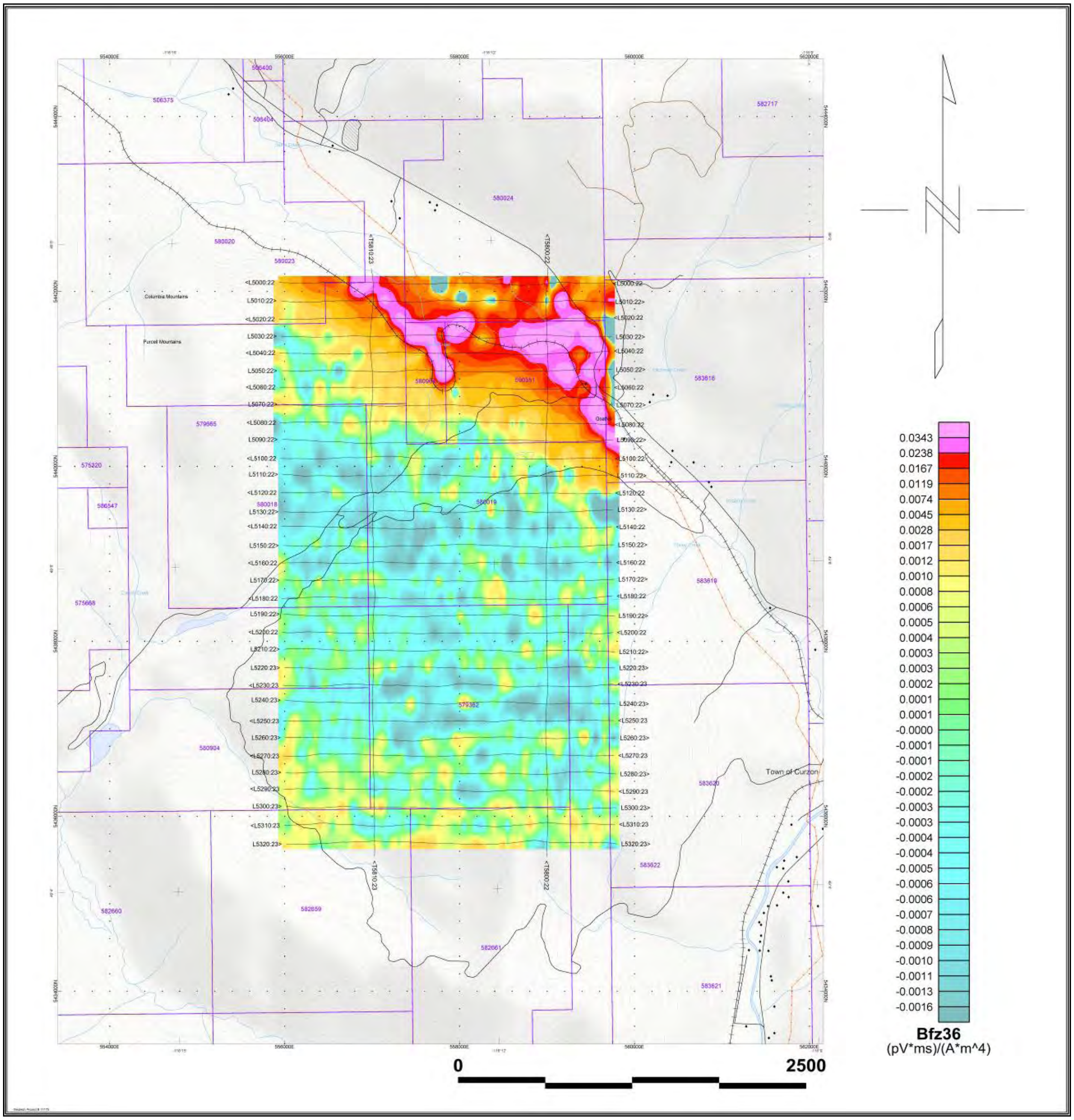


Goatfell Block - VTEM B-Field Z Component Profiles, Time Gates 0.220 to 7.036 ms

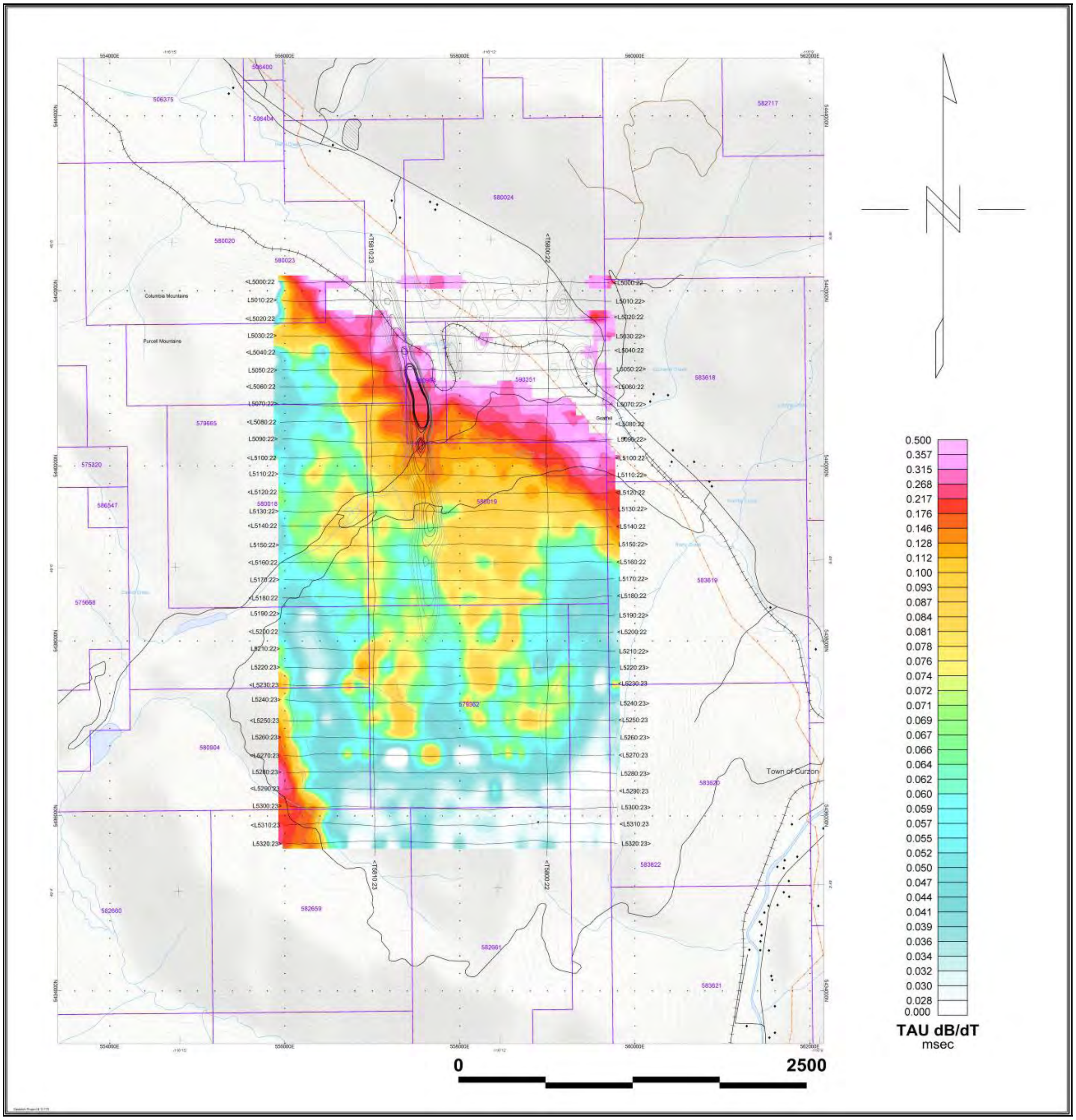
[1] Full size geophysical maps are also available in PDF format on the final DVD



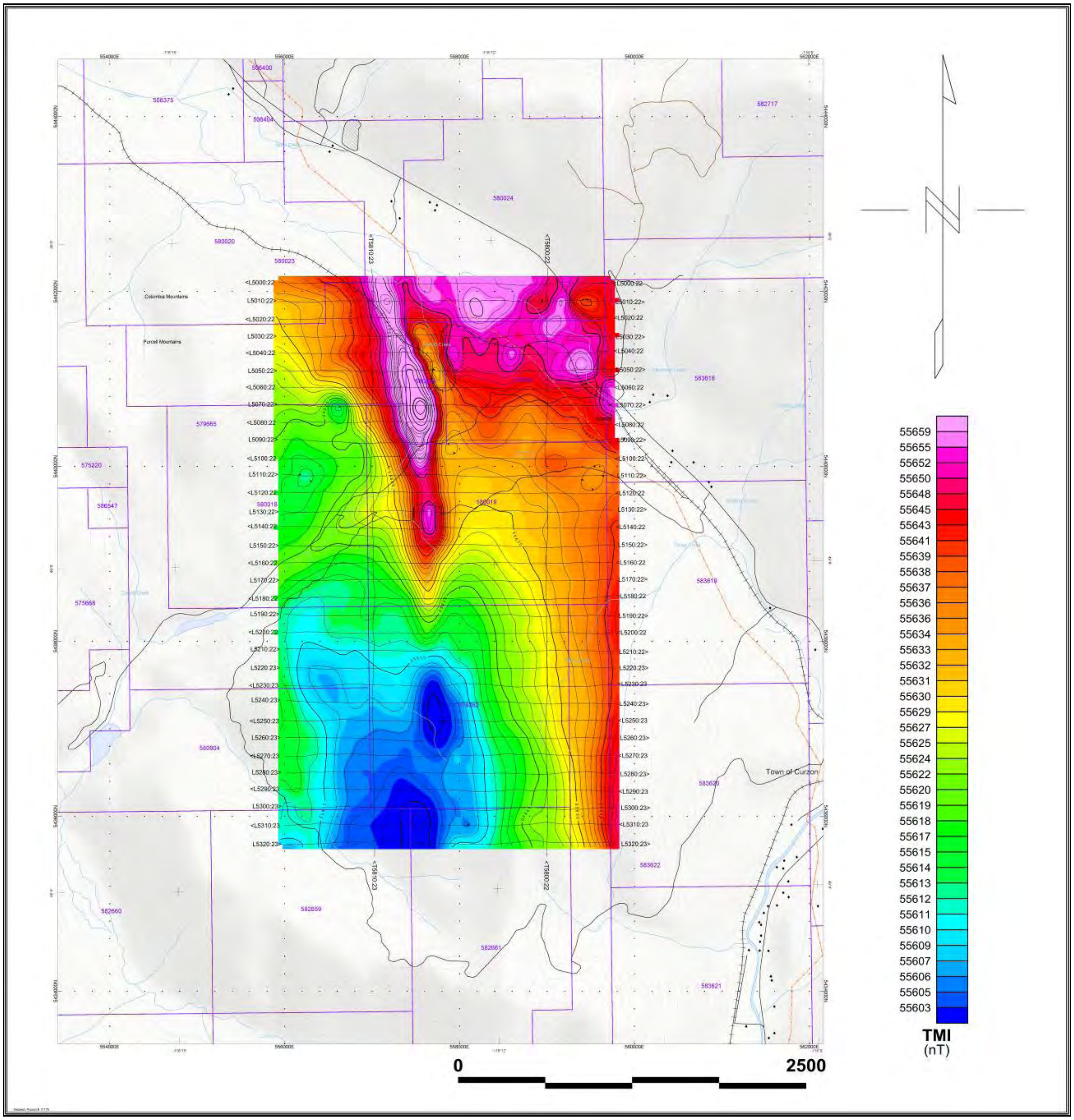
Goatfell Block - VTEM dB/dt Z Component Profiles, Time Gates 0.220 to 7.036 ms



Goatfell Block - VTEM B-Field Z Component Channel 36, Time Gate 2.021 ms



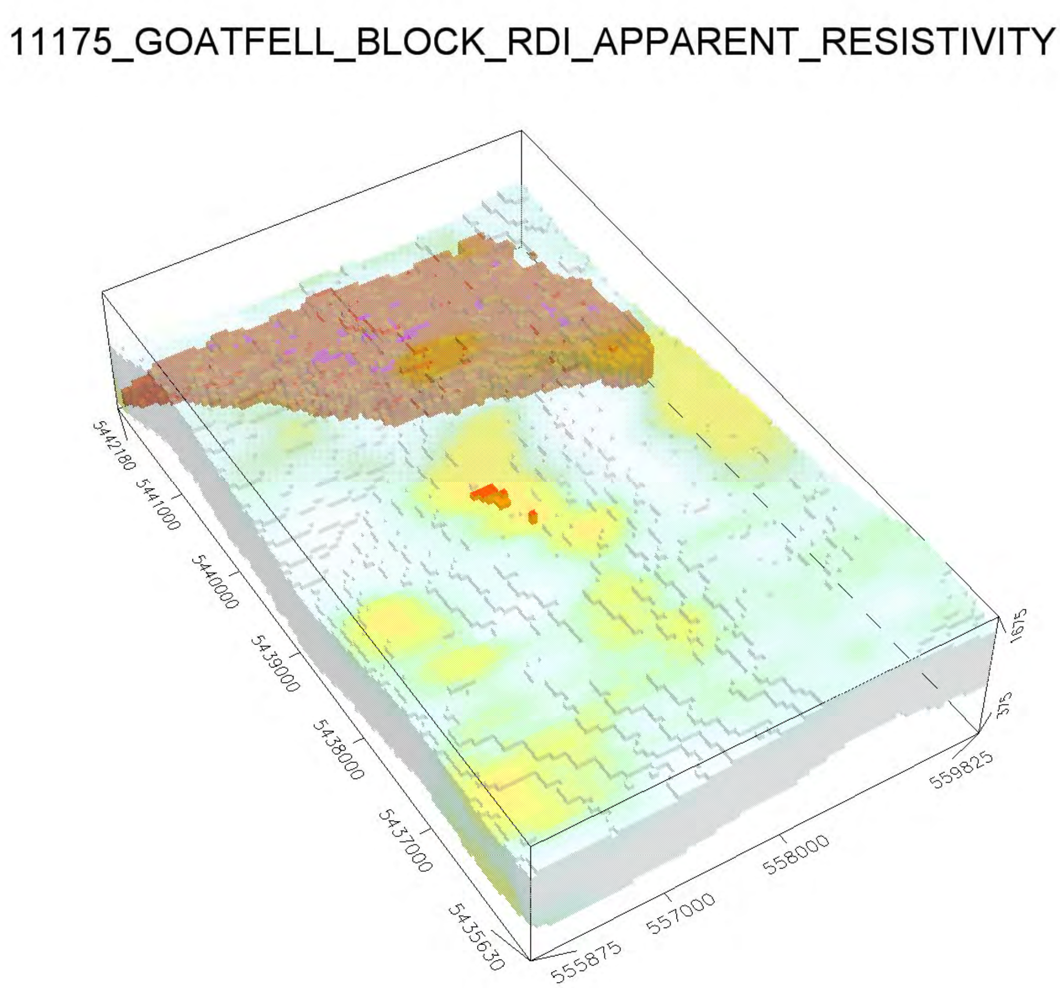
Goatfell Block – dB/dt Calculated Time Constant (Tau) with contours of anomaly areas of the Calculated Vertical Derivative of TMI



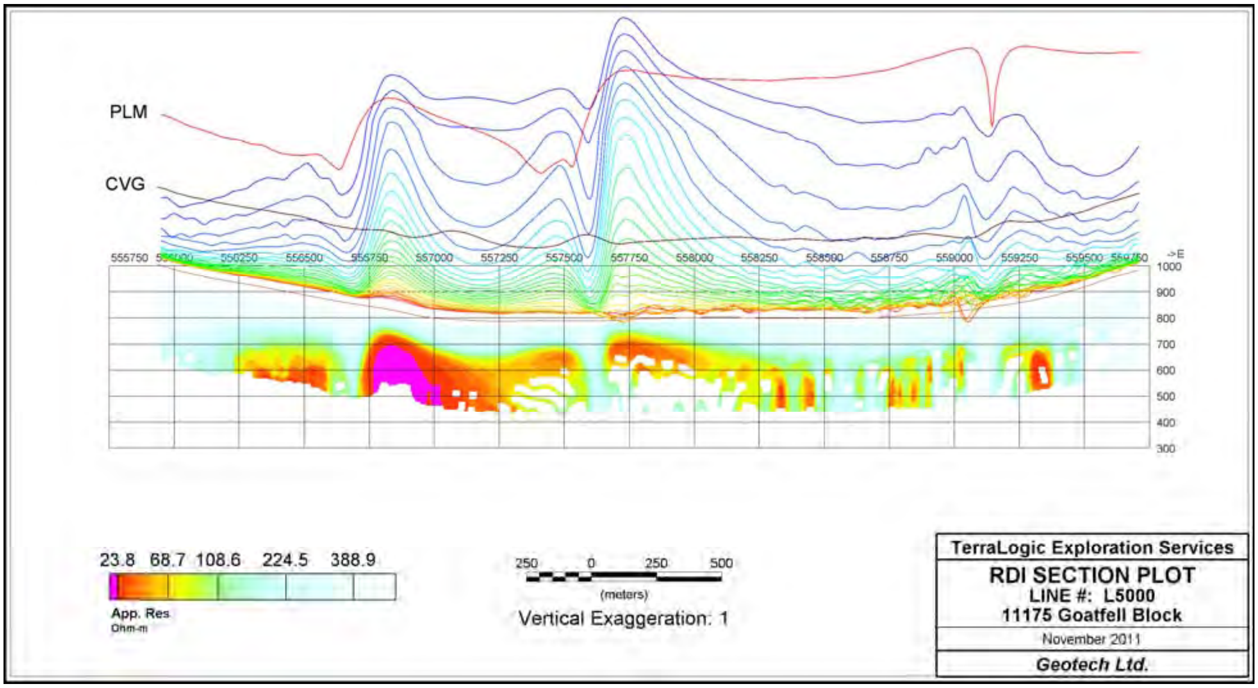
Goatfell Block - Total Magnetic Intensity (TMI)

Resistivity Depth Image (RDI) MAPS

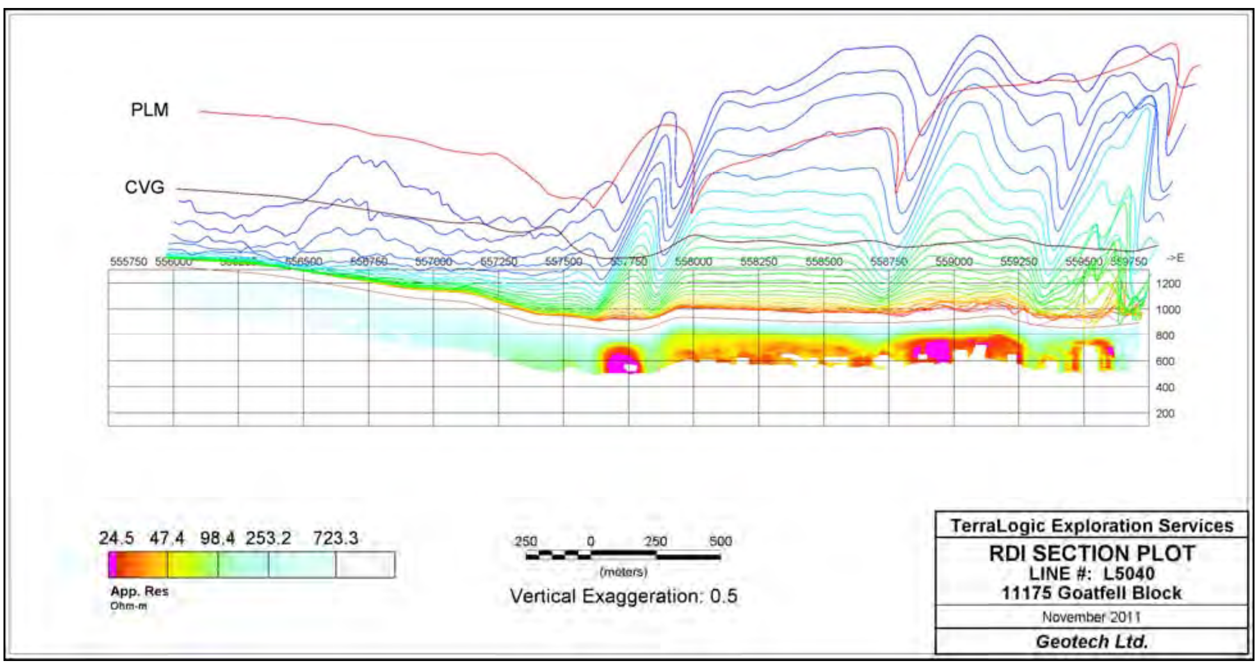
3D Resistivity Depth Images (RDI)



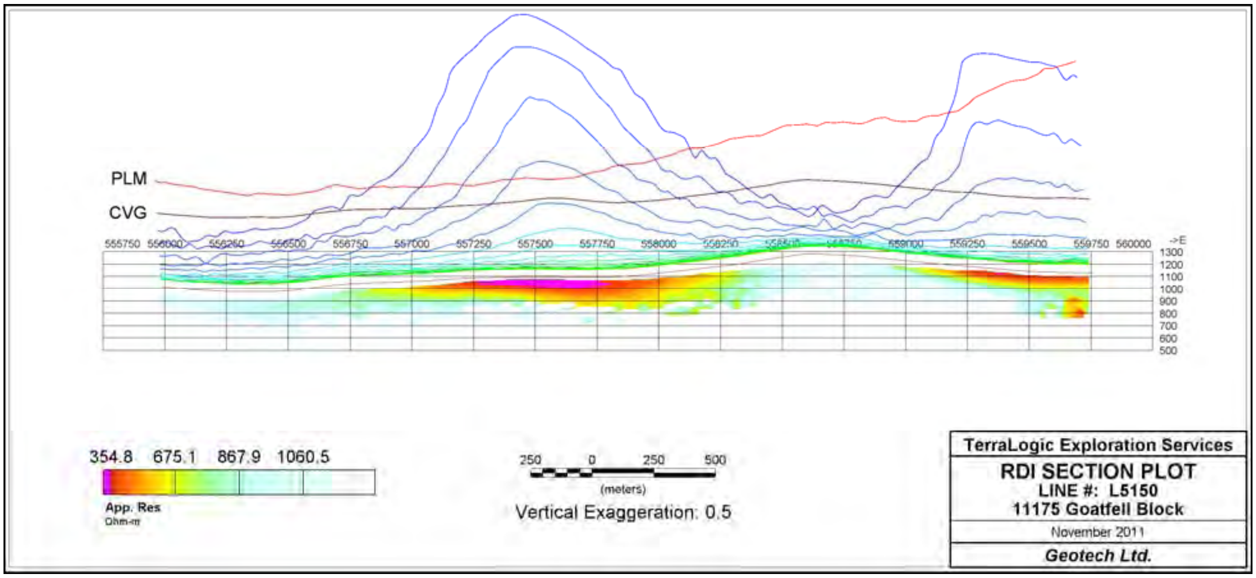
Goatfell Block



RDI Sections - Line 5000



RDI Sections - Line 5040



RDI Sections - Line 5150

APPENDIX E

GENERALIZED MODELING RESULTS OF THE VTEM SYSTEM

Introduction

The VTEM system is based on a concentric or central loop design, whereby, the receiver is positioned at the centre of a transmitter loop that produces a primary field. The wave form is a bi-polar, modified square wave with a turn-on and turn-off at each end.

During turn-on and turn-off, a time varying field is produced (dB/dt) and an electro-motive force (emf) is created as a finite impulse response. A current ring around the transmitter loop moves outward and downward as time progresses. When conductive rocks and mineralization are encountered, a secondary field is created by mutual induction and measured by the receiver at the centre of the transmitter loop.

Efficient modeling of the results can be carried out on regularly shaped geometries, thus yielding close approximations to the parameters of the measured targets. The following is a description of a series of common models made for the purpose of promoting a general understanding of the measured results.

A set of models has been produced for the Geotech VTEM® system dB/dT Z and X components (see models E1 to E15). The Maxwell ™ modeling program (EMIT Technology Pty. Ltd. Midland, WA, AU) used to generate the following responses assumes a resistive half-space. The reader is encouraged to review these models, so as to get a general understanding of the responses as they apply to survey results. While these models do not begin to cover all possibilities, they give a general perspective on the simple and most commonly encountered anomalies.

As the plate dips and departs from the vertical position, the peaks become asymmetrical.

As the dip increases, the aspect ratio (Min/Max) decreases and this aspect ratio can be used as an empirical guide to dip angles from near 90º to about 30º. The method is not sensitive enough where dips are less than about 30º.

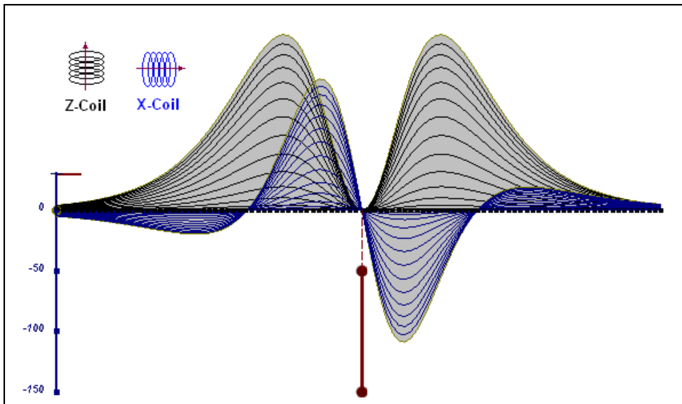


Fig E-1: vertical thin plate

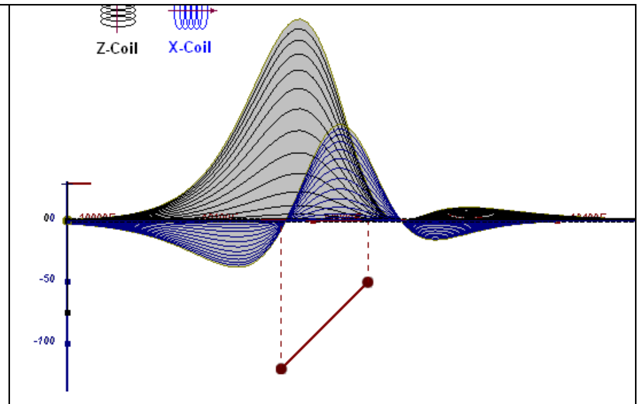


Fig E-2: inclined thin plate

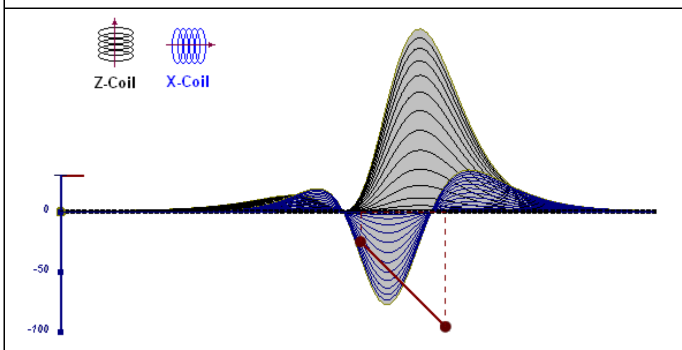


Fig E-3: inclined thin plate

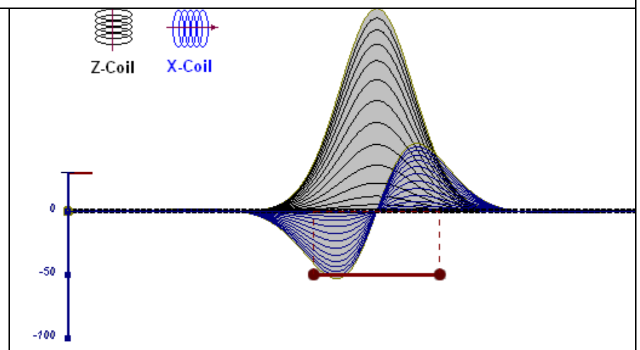


Fig E-4: horizontal thin plate

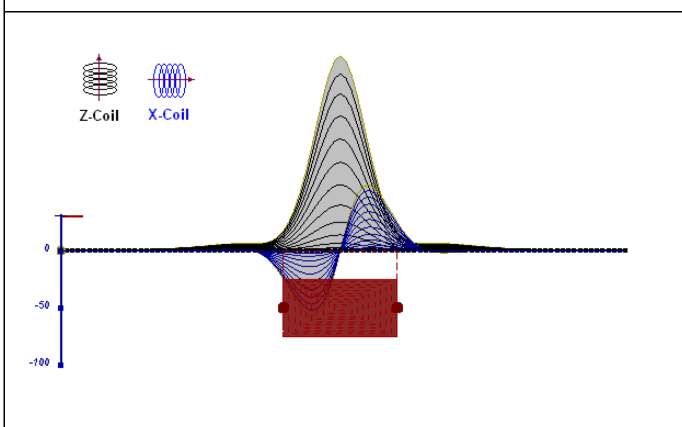


Figure E-5: horizontal thick plate (linear scale of the response)

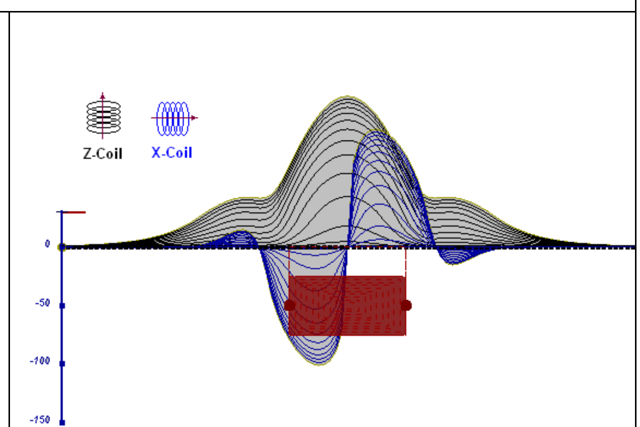


Figure E-6: horizontal thick plate (log scale of the response)

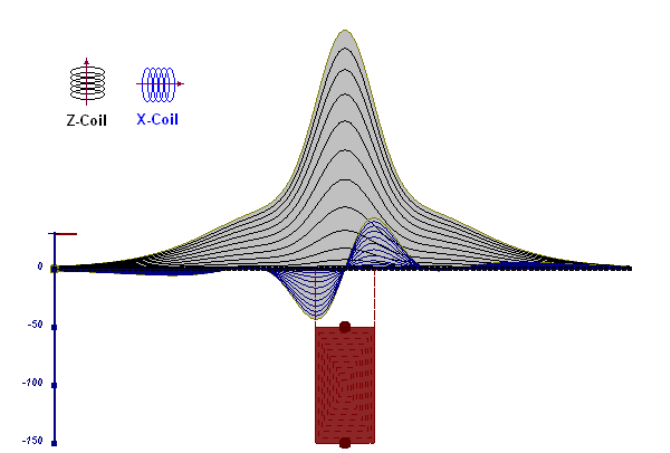


Figure E-7: vertical thick plate (linear scale of the response). 50 m depth

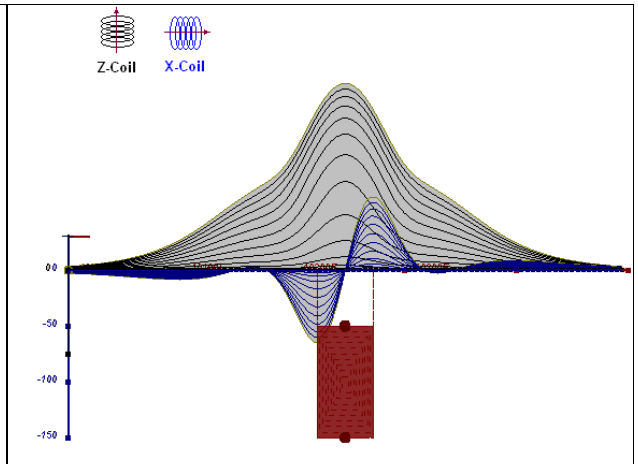


Figure E-8: vertical thick plate (log scale of the response). 50 m depth

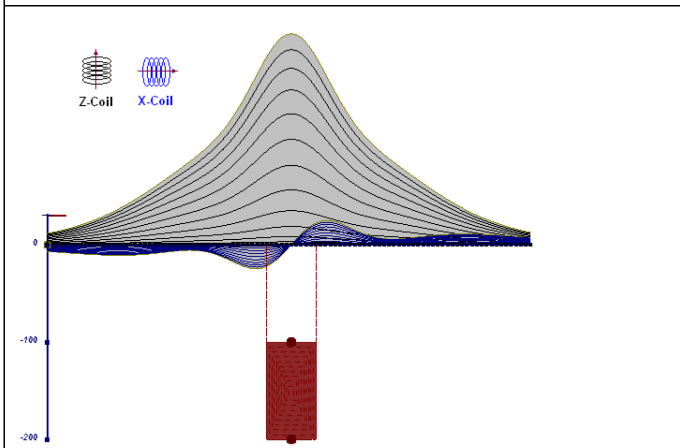


Fig E-9: vertical thick plate (linear scale of the response). 100 m depth

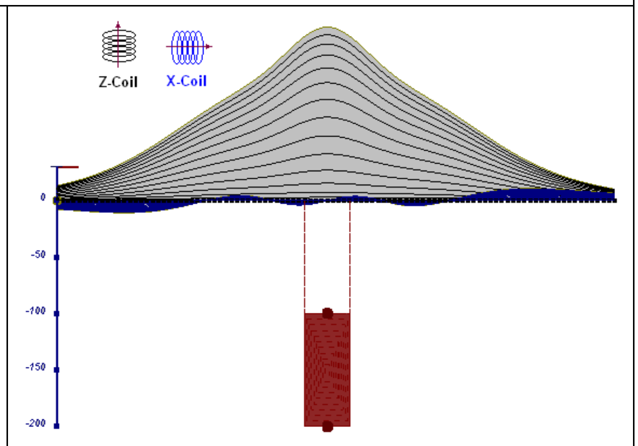


Fig E-10: vertical thick plate (linear scale of the response). Depth/hor.thickness=2.5

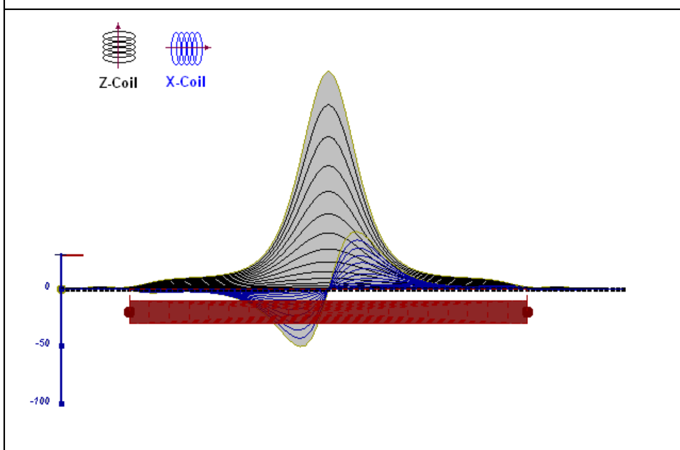


Fig E-10: horizontal thick plate (linear scale of the response)

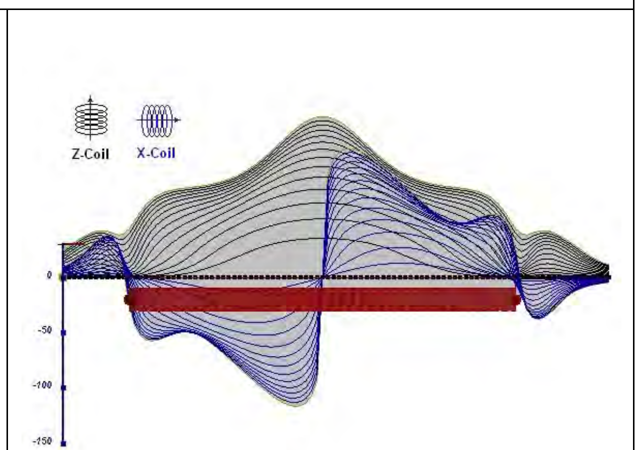


Fig E-11: horizontal thick plate (log scale of the response)

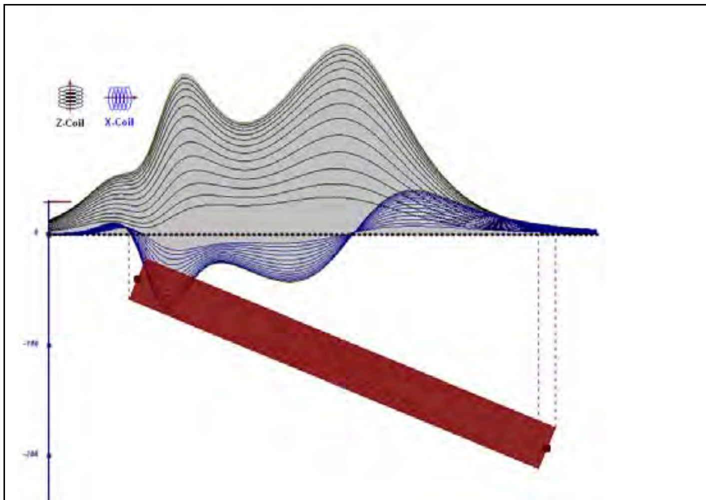


Fig E-12: inclined long thick plate

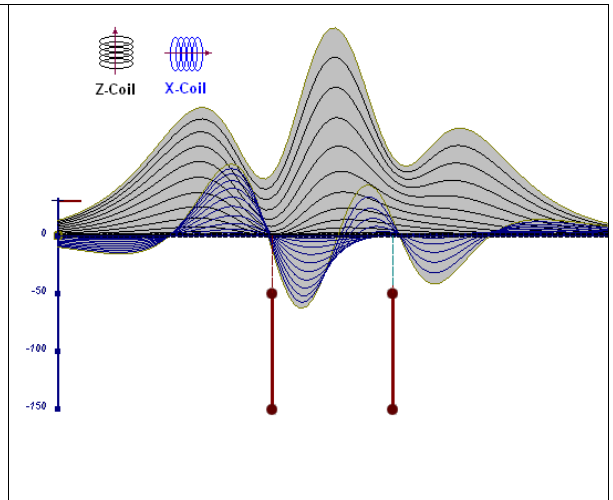


Fig E-13: two vertical thin plates

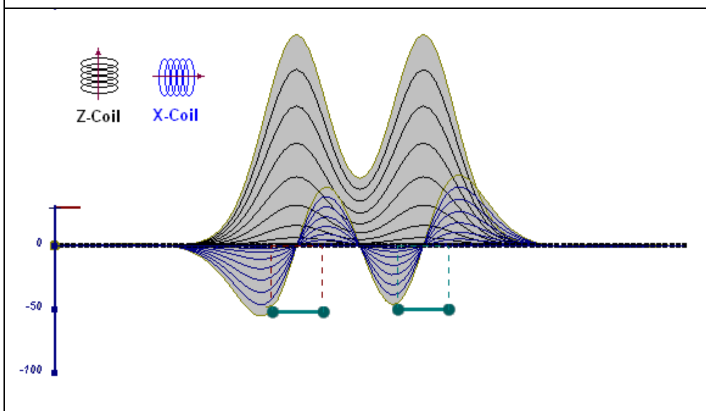


Fig E-14: two horizontal thin plates

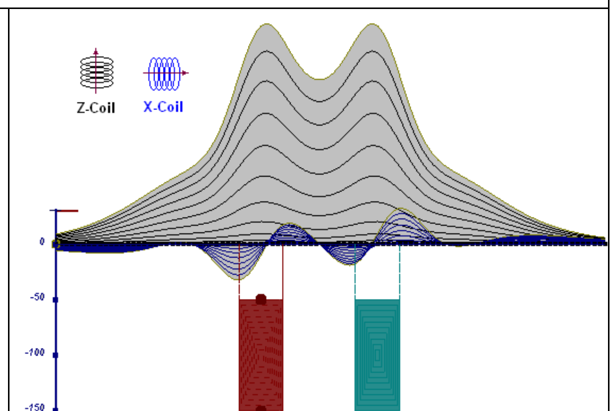


Fig E-15: two vertical thick plates

The same type of target but with different thickness, for example, creates different form of the response:

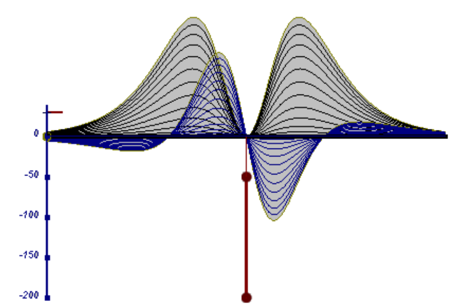
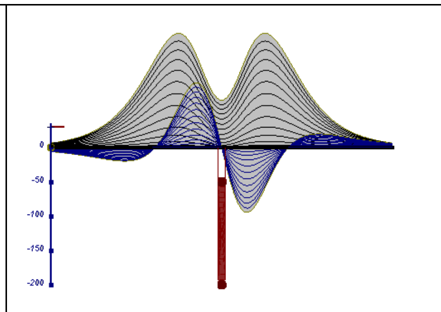
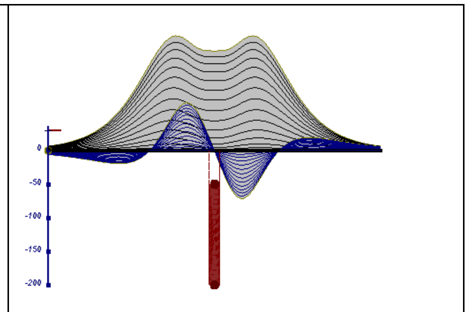
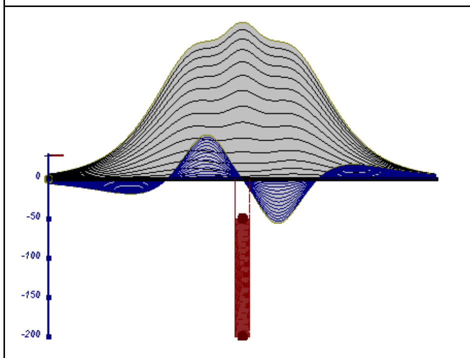
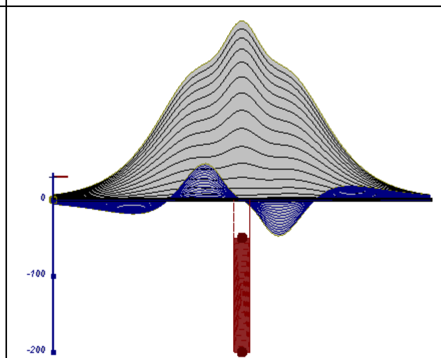
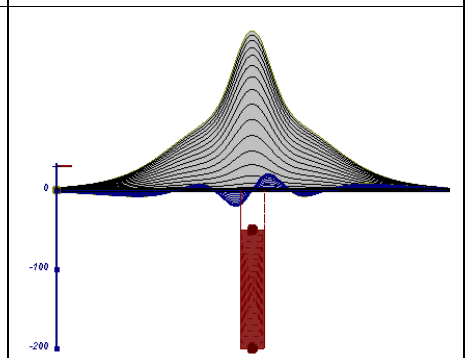
		
“thin”	10 m thickness	15 m thickness
		
18 m thickness	20 m thickness	30 m thickness

Fig.E-16 Conductive vertical plate, depth 50 m, strike length 200 m, depth extend 150 m.

Alexander Prikhodko, PhD, P.Geo
Geotech Ltd.

September 2010

APPENDIX F

EM TIME CONSTANT (TAU) ANALYSIS

Estimation of time constant parameter[1] in transient electromagnetic method is one of the steps toward the extraction of the information about conductance's beneath the surface from TEM measurements.

The most reliable method to discriminate or rank conductors from overburden, background or one and other is by calculating the EM field decay time constant (TAU parameter), which directly depends on conductance despite their depth and accordingly amplitude of the response.

Theory

As established in electromagnetic theory, the magnitude of the electro-motive force (emf) induced is proportional to the time rate of change of primary magnetic field at the conductor. This emf causes eddy currents to flow in the conductor with a characteristic transient decay, whose Time Constant (Tau) is a function of the conductance of the survey target or conductivity and geometry (including dimensions) of the target. The decaying currents generate a proportional secondary magnetic field, the time rate of change of which is measured by the receiver coil as induced voltage during the Off time.

The receiver coil output voltage (**e_0**) is proportional to the time rate of change of the secondary magnetic field and has the form,

$$e_0 \ \alpha \ (1 / \tau) \ e^{-(t/\tau)}$$

Where,
τ = L/R is the characteristic time constant of the target (TAU)
R = resistance
L = inductance

From the expression, conductive targets that have small value of resistance and hence large value of τ yield signals with small initial amplitude that decays relatively slowly with progress of time. Conversely, signals from poorly conducting targets that have large resistance value and smallτ, have high initial amplitude but decay rapidly with time[1] (Fig. F1).

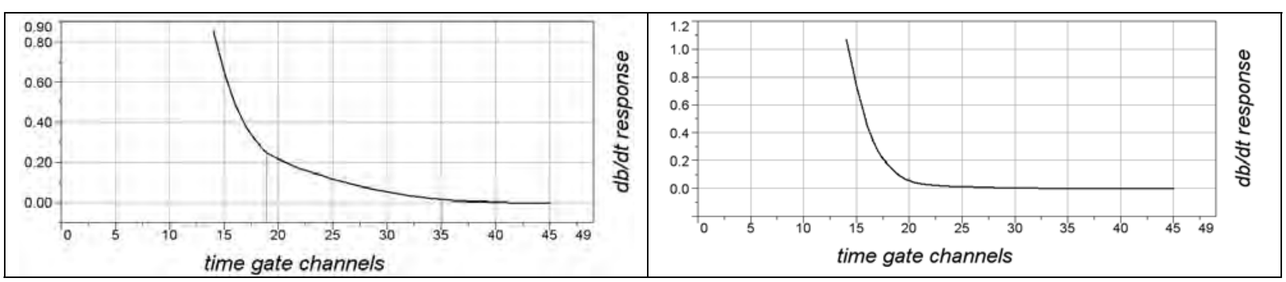


Figure F1 Left – presence of good conductor, right – poor conductor.

---

[1] McNeill, JD, 1980, "Applications of Transient Electromagnetic Techniques", Technical Note TN-7 page 5, Geonics Limited, Mississauga, Ontario.

EM Time Constant (Tau) Calculation

The EM Time-Constant (TAU) is a general measure of the speed of decay of the electromagnetic response and indicates the presence of eddy currents in conductive sources as well as reflecting the “conductance quality” of a source. Although TAU can be calculated using either the measured dB/dt decay or the calculated B-field decay, dB/dt is commonly preferred due to better stability (S/N) relating to signal noise. Generally, TAU calculated on base of early time response reflects both near surface overburden and poor conductors whereas, in the late ranges of time, deep and more conductive sources, respectively. For example early time TAU distribution in an area that indicates conductive overburden is shown in Figure 2.

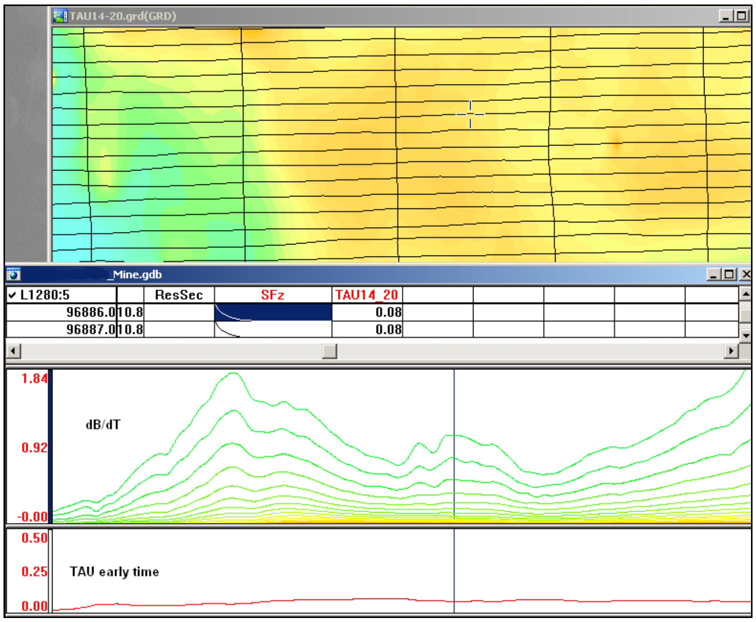


Figure F2 – Map of early time TAU. Area with overburden conductive layer and local sources.

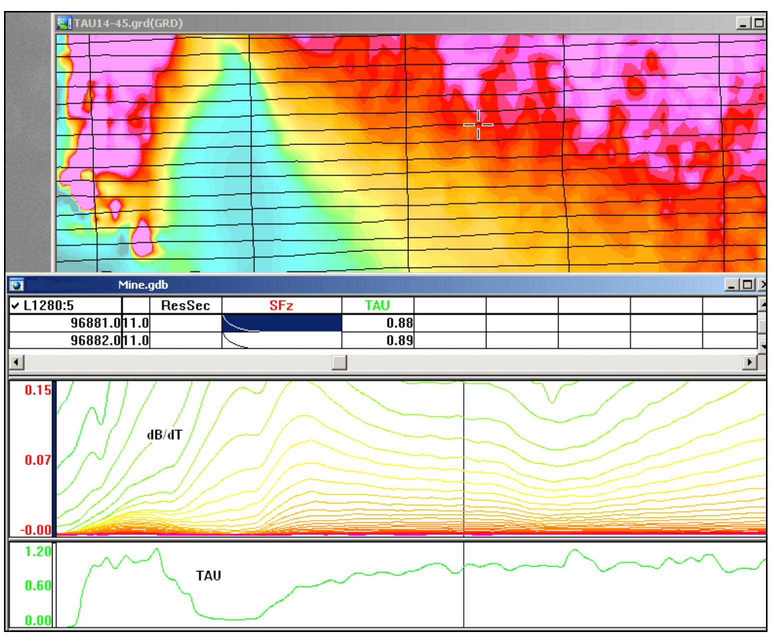


Figure F3 – Map of full time range TAU with EM anomaly due to deep highly conductive target.

There are many advantages of TAU maps:

- TAU depends only on one parameter (conductance) in contrast to response magnitude;
- TAU is integral parameter, which covers time range and all conductive zones and targets are displayed independently of their depth and conductivity on a single map.
- Very good differential resolution in complex conductive places with many sources with different conductivity.
- Signs of the presence of good conductive targets are amplified and emphasized independently of their depth and level of response accordingly.

In the example shown in Figure 4 and 5, three local targets are defined, each of them with a different depth of burial, as indicated on the resistivity depth image (RDI). All are very good conductors but the deeper target (number 2) has a relatively weak dB/dt signal yet also features the strongest total TAU (Figure 4). This example highlights the benefit of TAU analysis in terms of an additional target discrimination tool.

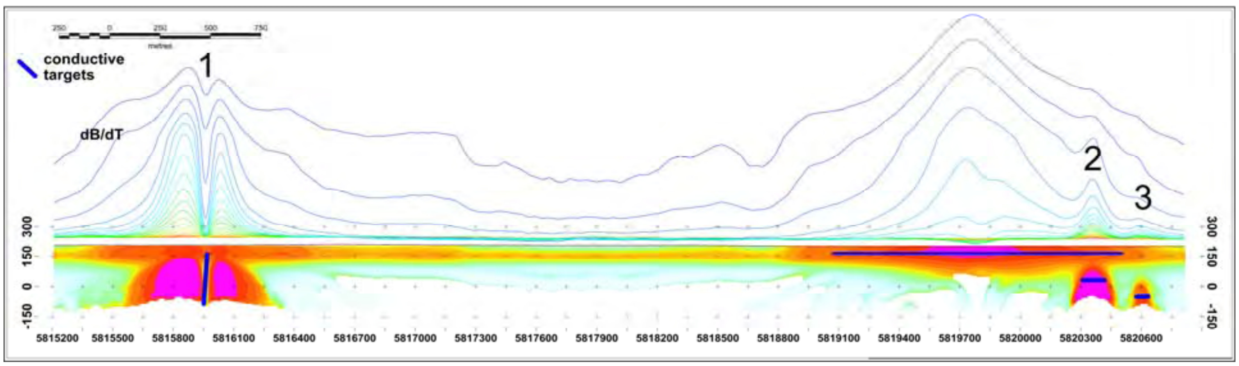


Figure F4 – dB/dt profile and RDI with different depths of targets.

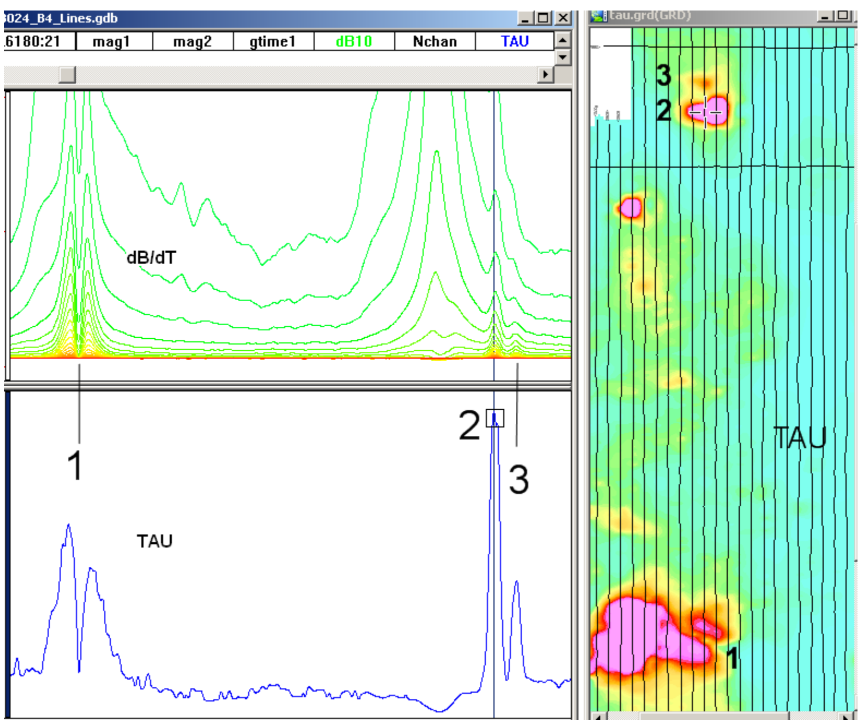


Figure F5 – Map of total TAU and dB/dt profile.

The EM Time Constants for dB/dt and B-field were calculated using the "sliding Tau" in-house program developed at Geotech[2]. The principle of the calculation is based on using of time window (4 time channels) which is sliding along the curve decay and looking for latest time channels which have a response above the level of noise and decay. The EM decays are obtained from all available decay channels, starting at the latest channel. Time constants are taken from a least square fit of a straight-line (log/linear space) over the last 4 gates above a pre-set signal threshold level (Figure F6). Threshold settings are pointed in the "label" property of TAU database channels. The sliding Tau method determines that, as the amplitudes increase, the time-constant is taken at progressively later times in the EM decay. Conversely, as the amplitudes decrease, Tau is taken at progressively earlier times in the decay. If the maximum signal amplitude falls below the threshold, or becomes negative for any of the 4 time gates, then Tau is not calculated and is assigned a value of "dummy" by default.

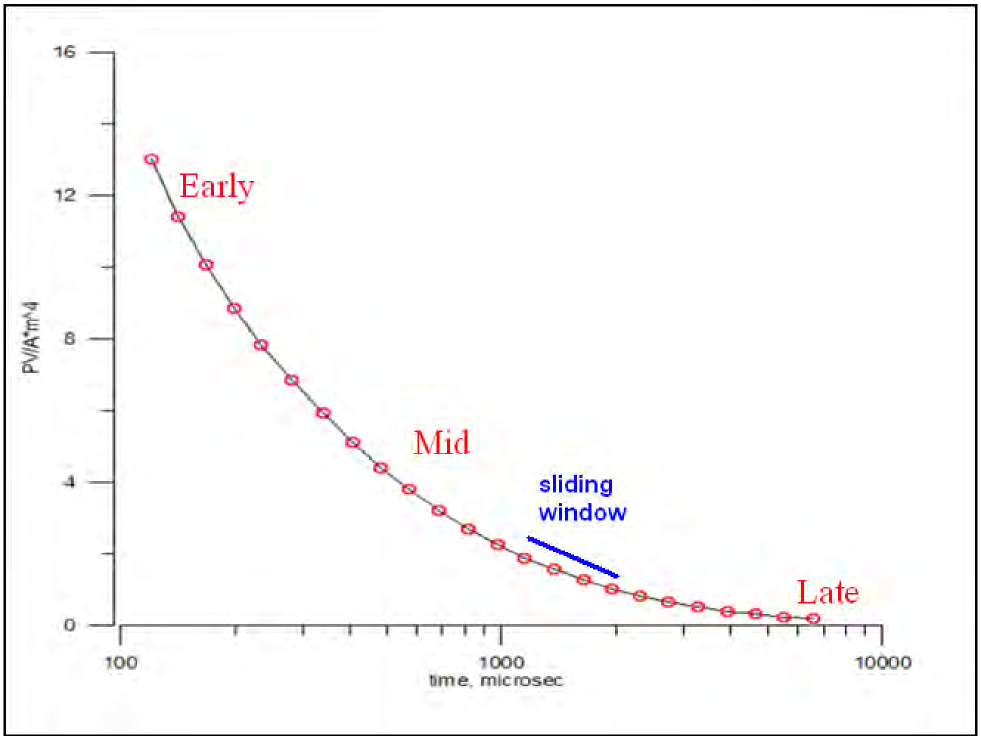


Figure F6 - Typical dB/dt decays of Vtem data

Alexander Prikhodko, PhD, P.Geo
Geotech Ltd.

September 2010

[2] by A.Prikhodko

APPENDIX G

TEM Resistivity Depth Imaging (RDI)

Resistivity depth imaging (RDI) is technique used to rapidly convert EM profile decay data into an equivalent resistivity versus depth cross-section, by deconvolving the measured TEM data.
The used RDI algorithm of Resistivity-Depth transformation is based on scheme of the apparent resistivity transform of Maxwell A.Meju (1998)[1] and TEM response from conductive half-space. The program is developed by Alexander Prikhodko and depth calibrated based on forward plate modeling for VTEM system configuration (Fig. 1-10).

RDIs provide reasonable indications of conductor relative depth and vertical extent, as well as accurate 1D layered-earth apparent conductivity/resistivity structure across VTEM flight lines. Approximate depth of investigation of a TEM system, image of secondary field distribution in half space, effective resistivity, initial geometry and position of conductive targets is the information obtained on base of the RDIs.

Maxwell forward modeling with RDI sections from the synthetic responses (VTEM system)

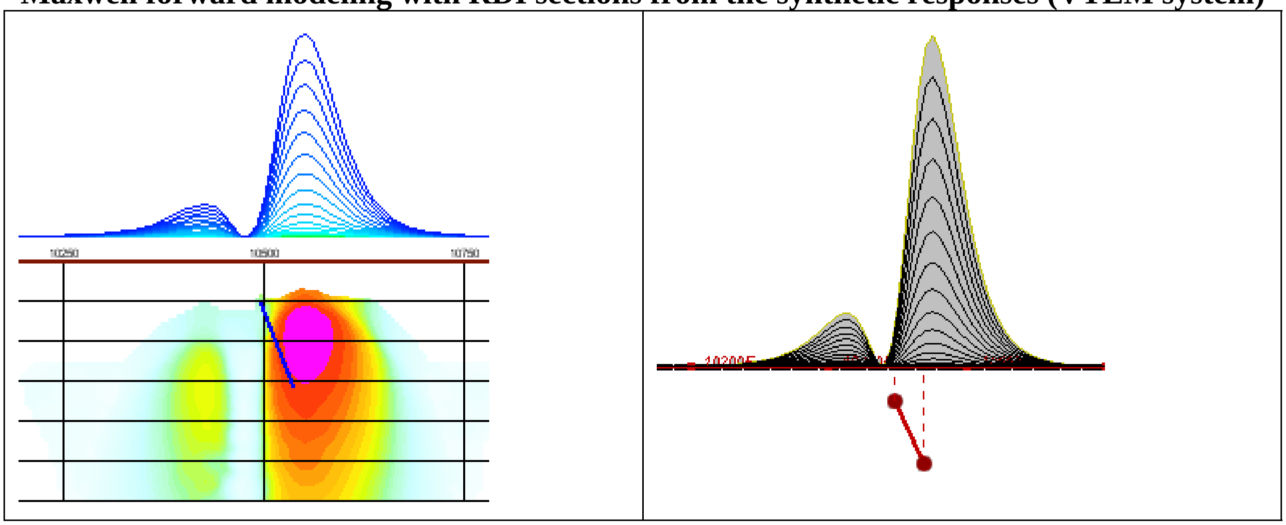


Fig. 1 Maxwell plate model and RDI from the calculated response for conductive "thin" plate (depth 50 m, dip 65 degree, depth extend 100 m).

[1] Maxwell A.Meju, 1998, Short Note: A simple method of transient electromagnetic data analysis, Geophysics, **63**, 405–410.

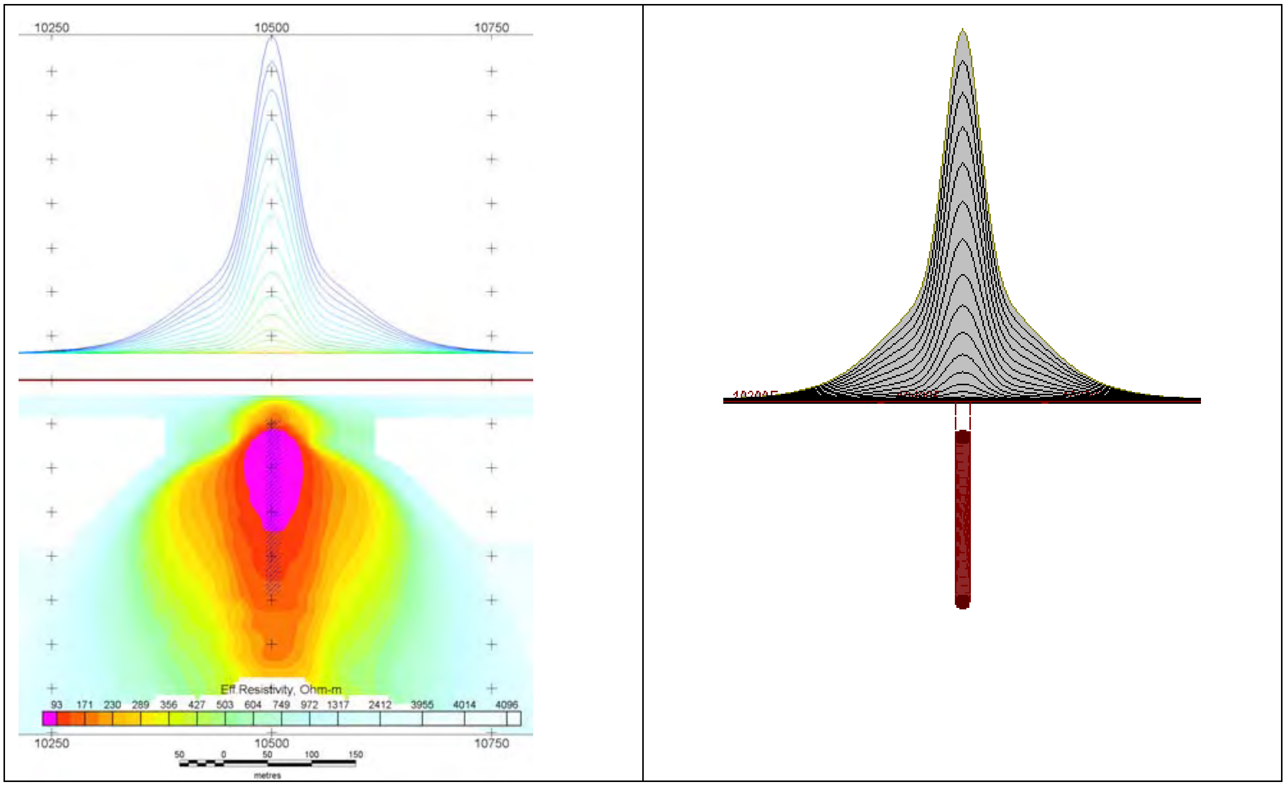


Fig. 2 Maxwell plate model and RDI from the calculated response for "thick" plate 18 m thickness, depth 50 m, depth extend 200 m).

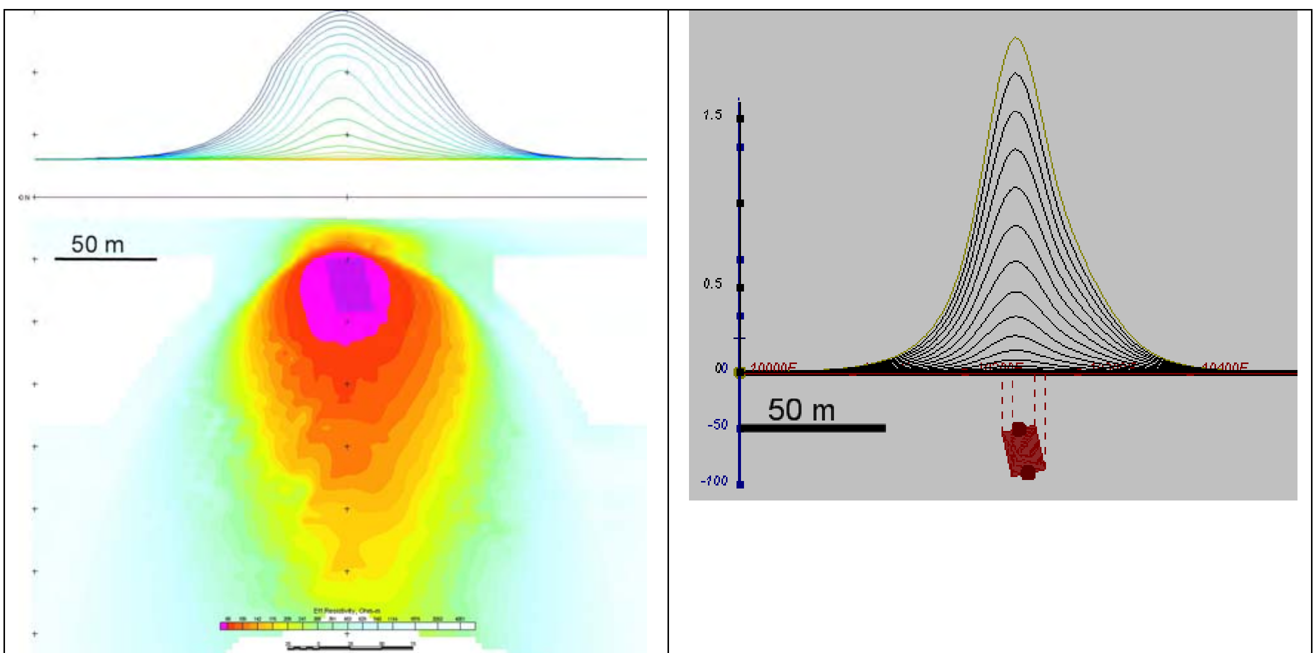


Fig.3 Maxwell plate model and RDI from the calculated response for bulk ("thick") 100 m length, 40 m depth extend, 30 m thickness

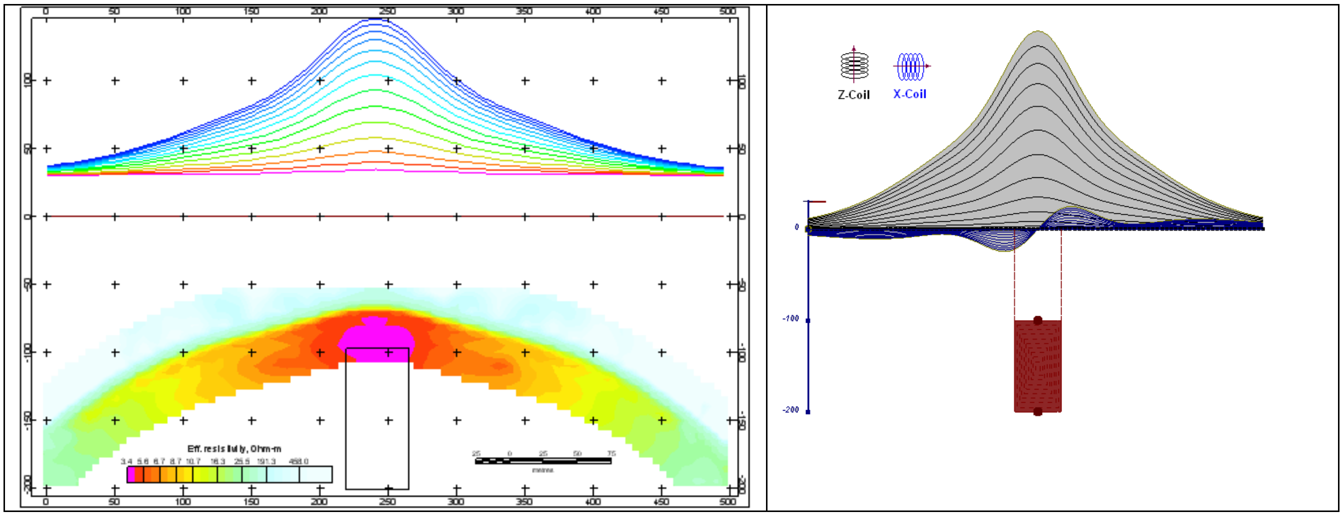


Fig. 4 Maxwell plate model and RDI from the calculated response for “thick” vertical target (depth 100 m, depth extend 100 m). 19-44 chan.

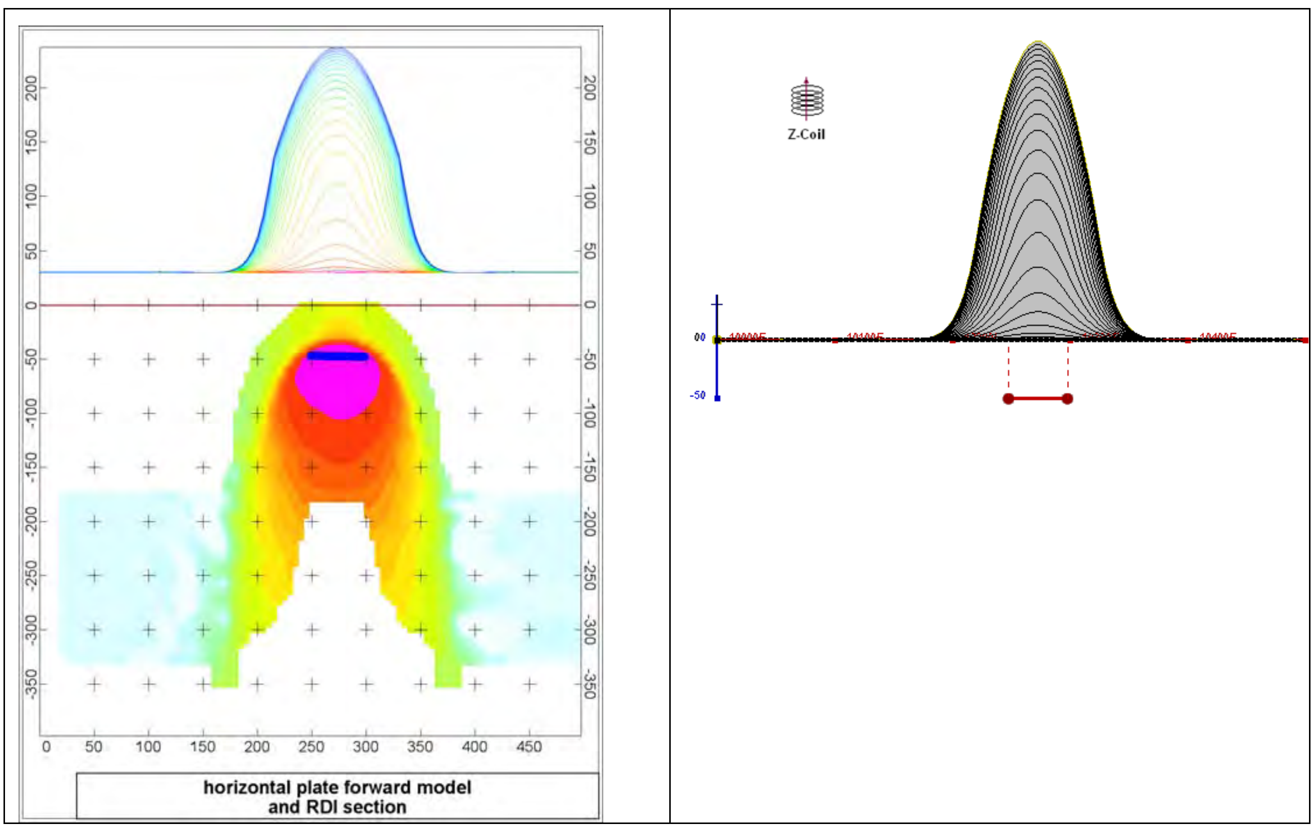


Fig. 5 Maxwell plate model and RDI from the calculated response for horizontal thin plate (depth 50 m, dim 50x100 m). 15-44 chan.

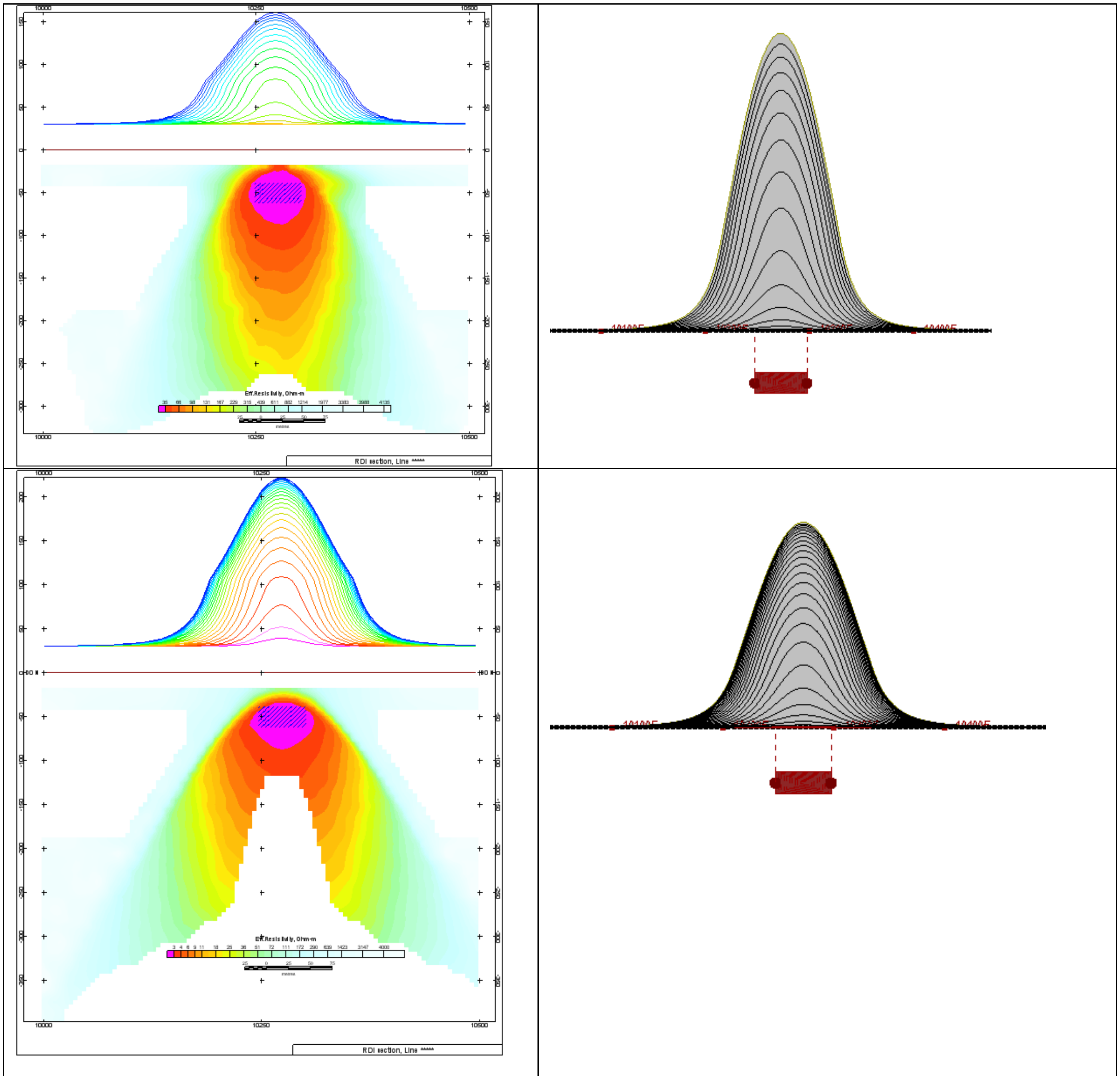


Fig.6 Maxwell plate model and RDI from the calculated response for horizontal thick (20m) plate – less conductive (on the top), more conductive (below)

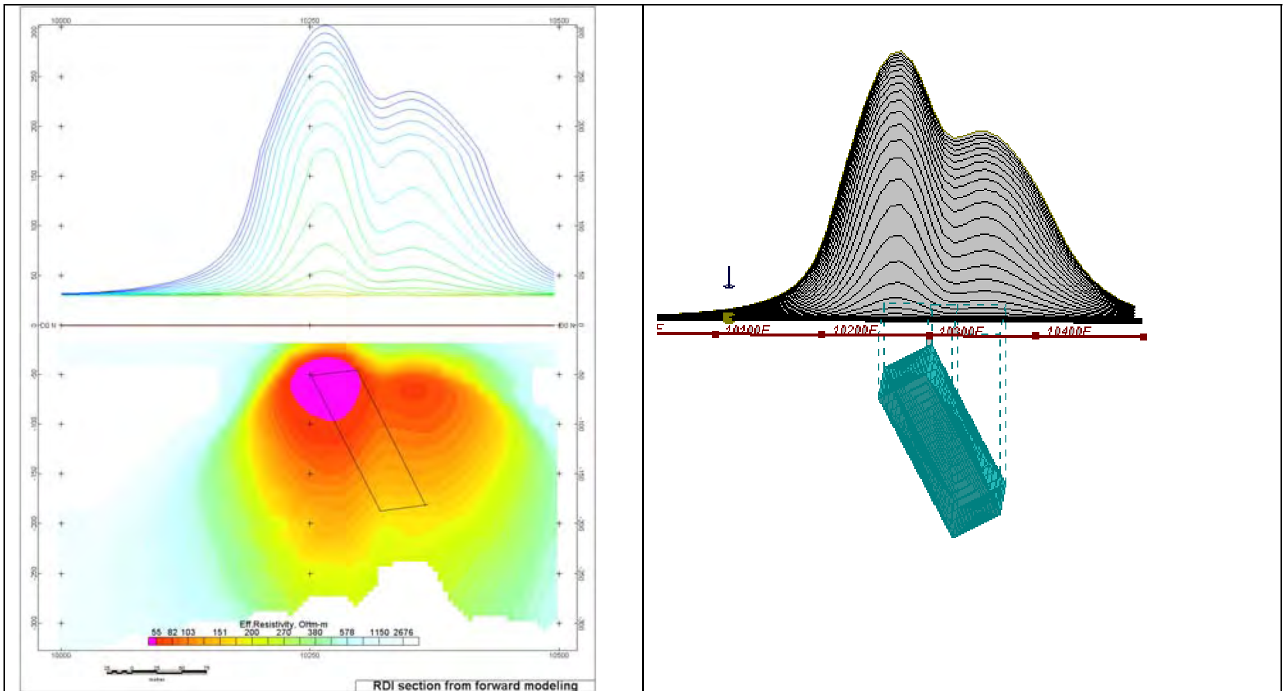


Fig.7 Maxwell plate model and RDI from the calculated response for inclined thick (50m) plate. Depth extend 150 m, depth to the target 50 m.

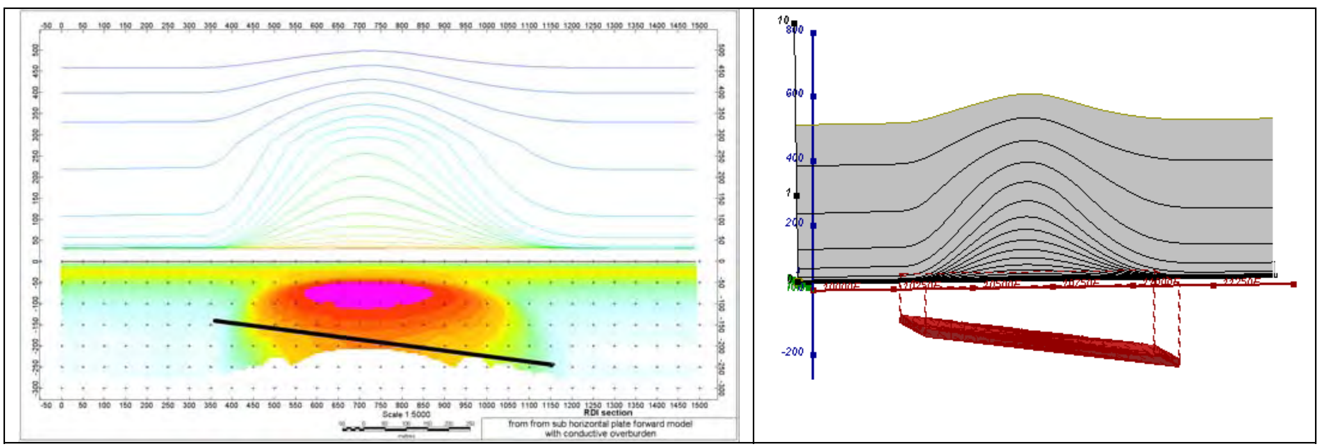


Fig.8 Maxwell plate model and RDI from the calculated response for the long, wide and deep subhorizontal plate (depth 140 m, dim 25x500x800 m) with conductive overburden.

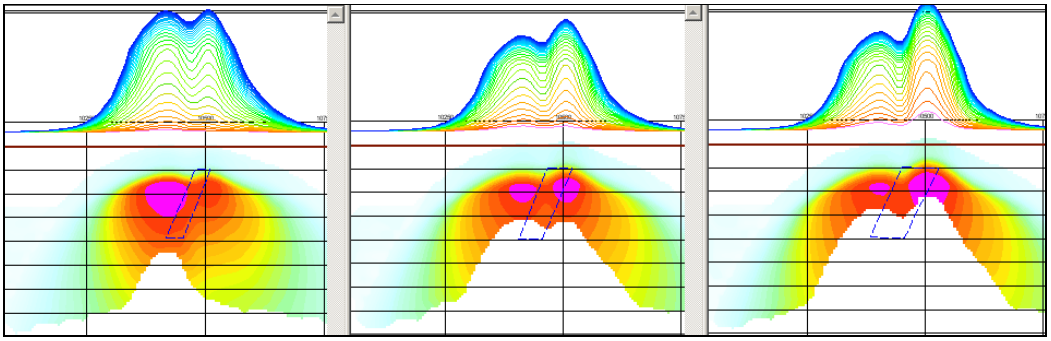


Fig.9 Maxwell plate models and RDIs from the calculated response for “thick” dipping plates (35, 50, 75 m thickness), depth 50 m, conductivity 2.5 S/m.

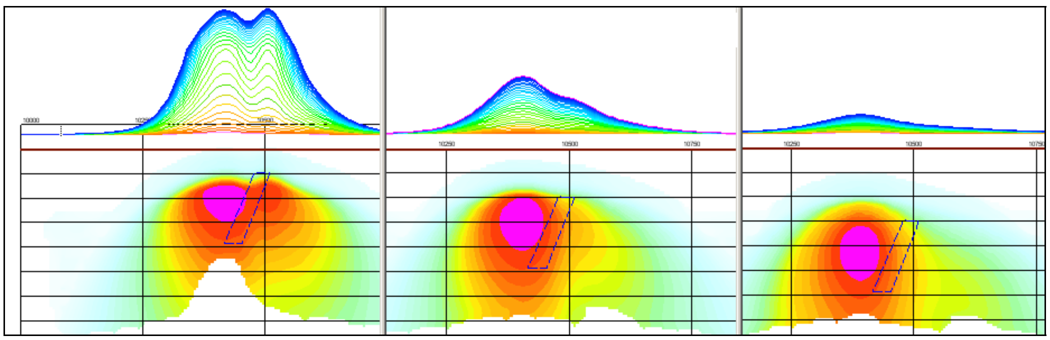


Fig.10 Maxwell plate models and RDIs from the calculated response for “thick” (35 m thickness) dipping plate on different depth (50, 100, 150 m),, conductivity 2.5 S/m.

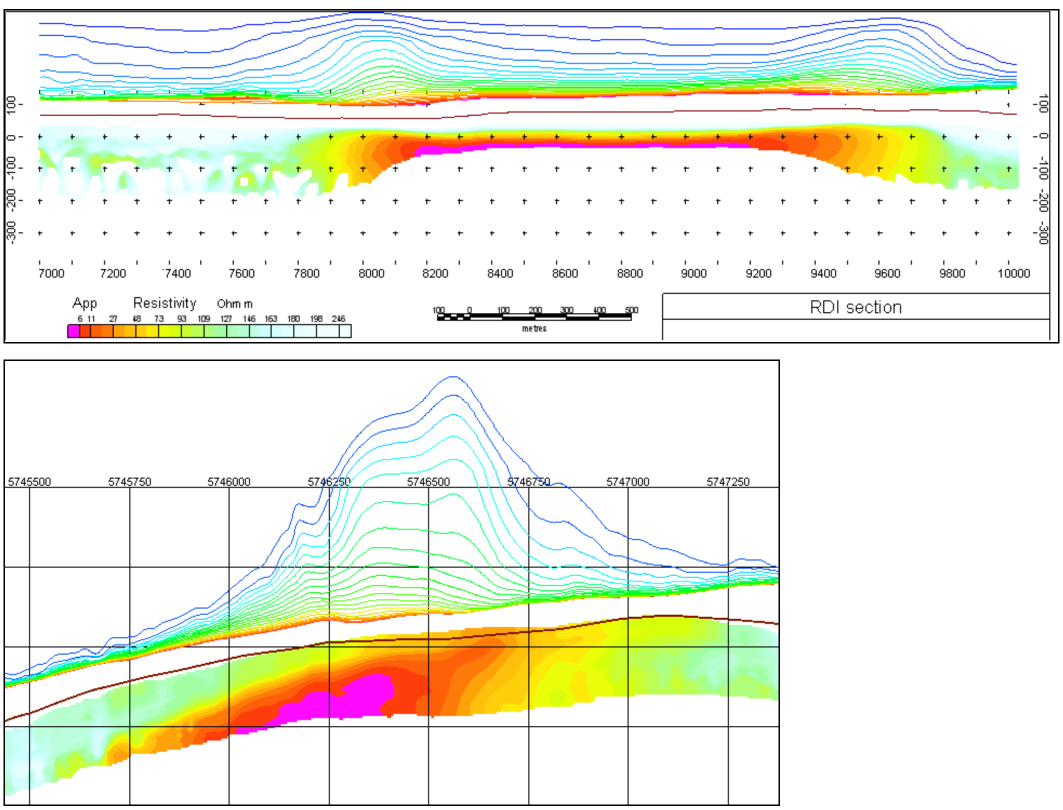
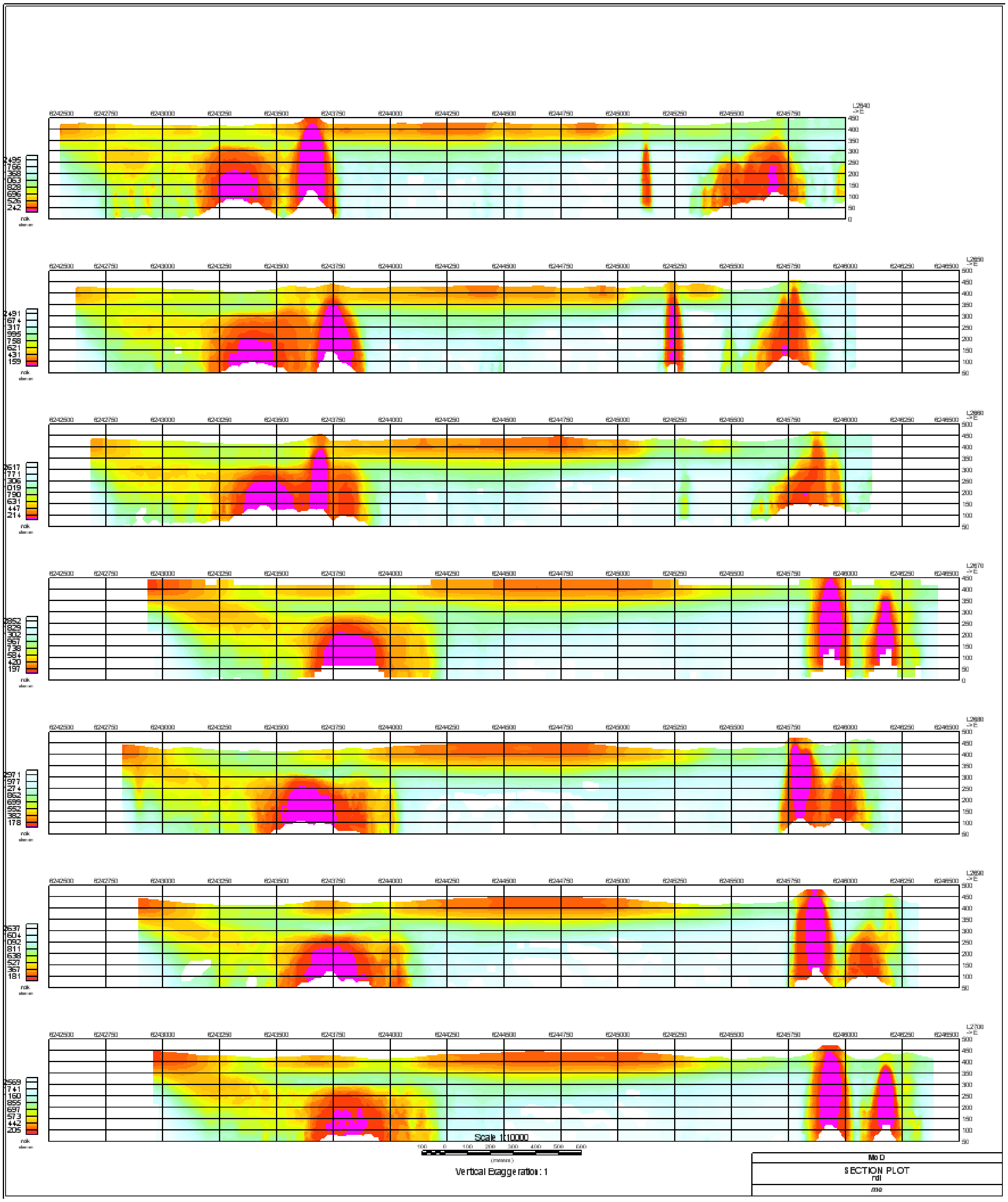


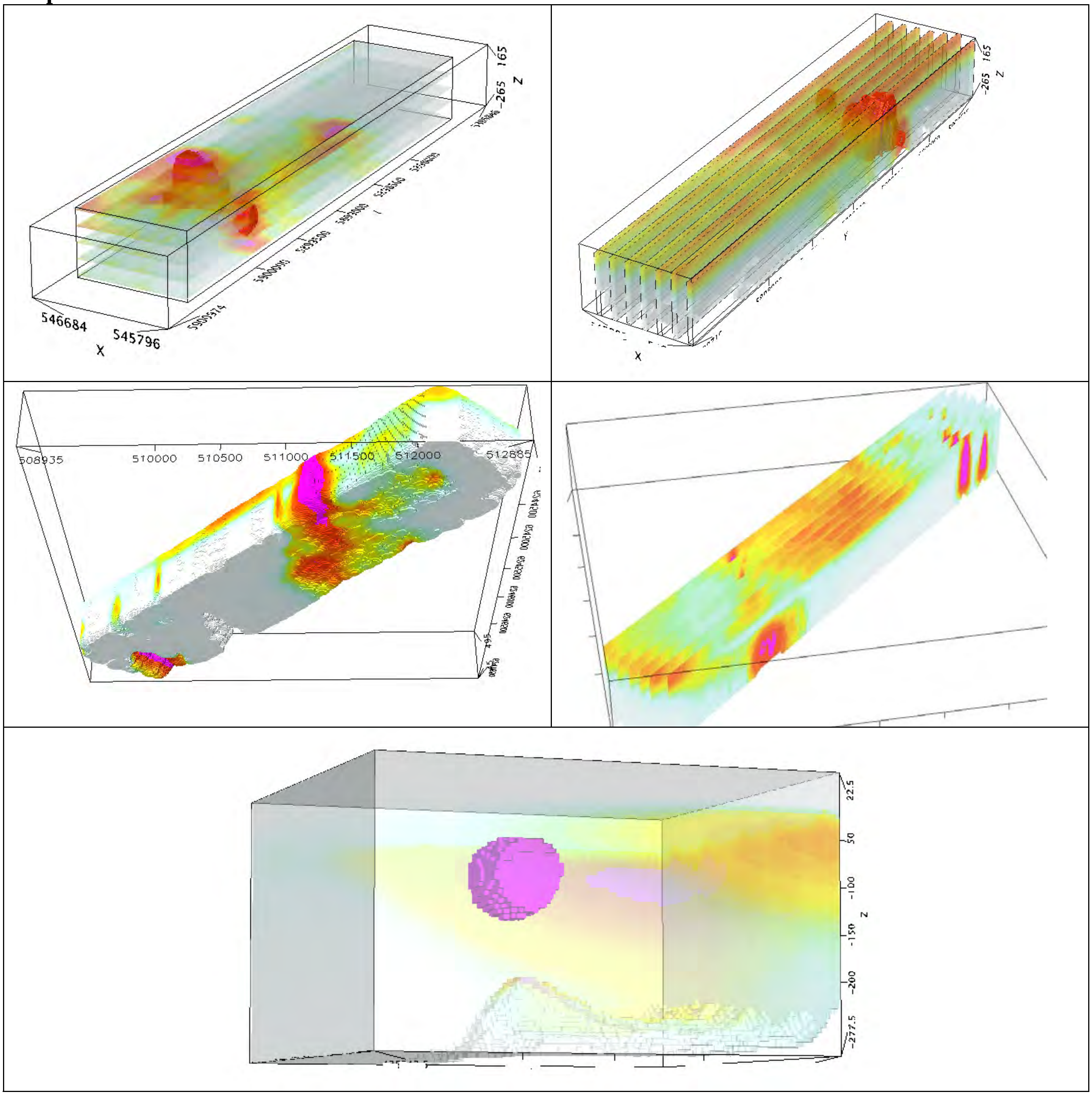
Fig.11 RDI section for the real horizontal and slightly dipping conductive layers

Forms of RDI presentation

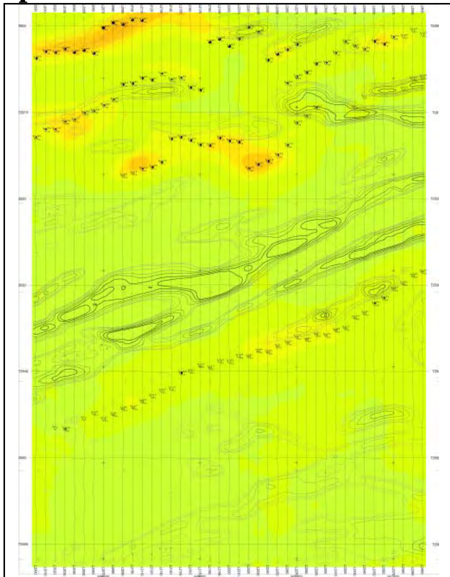
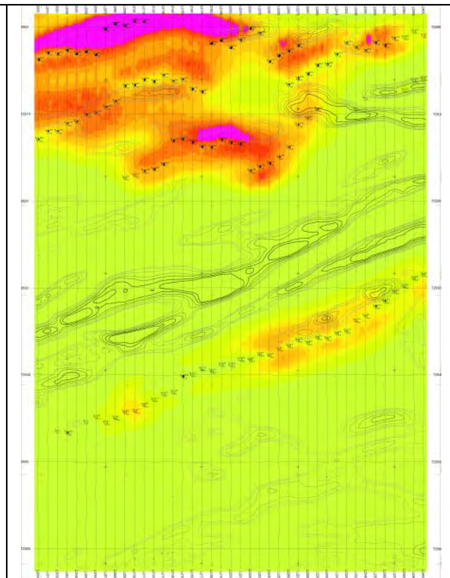
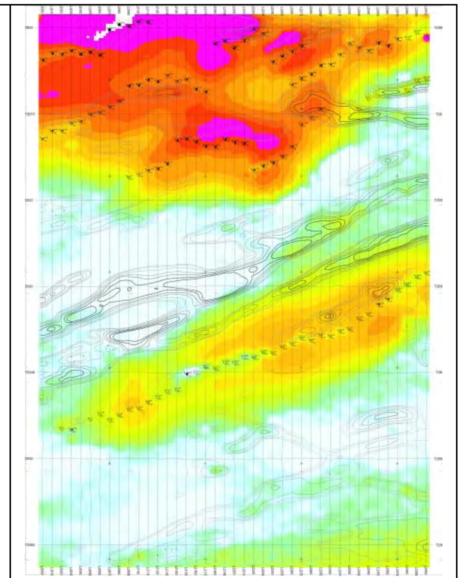
Presentation of series of lines



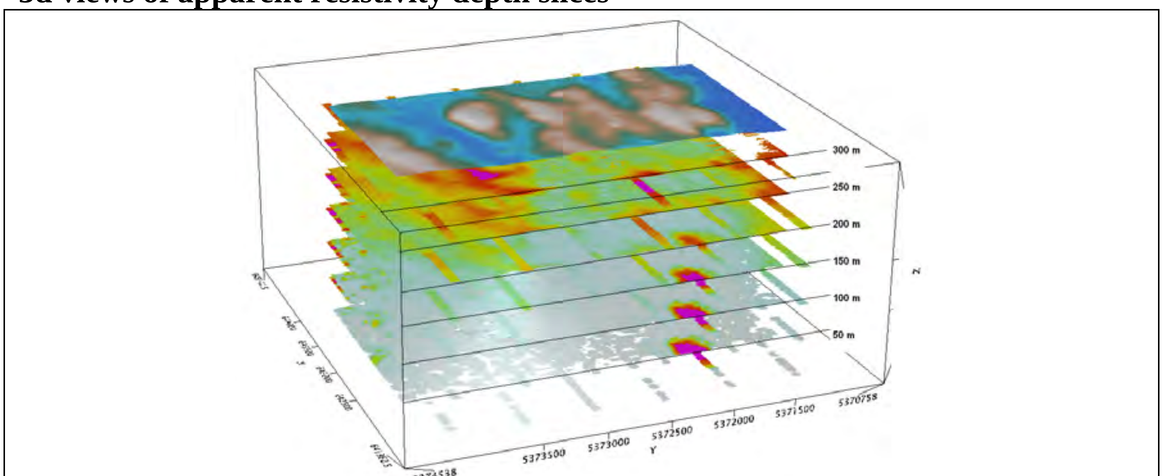
3d presentation of RDIs

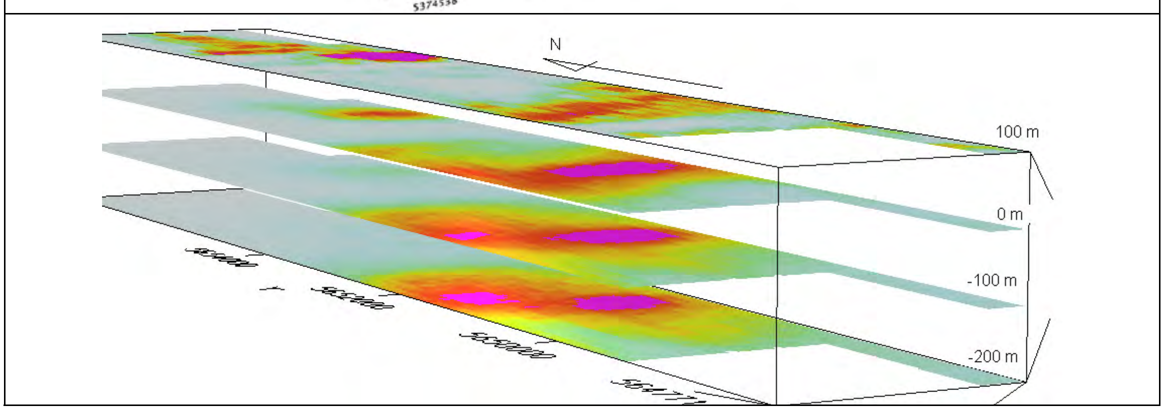


Apparent Resistivity Depth Slices plans

		
0 m (surface)	-100 m	-200 m

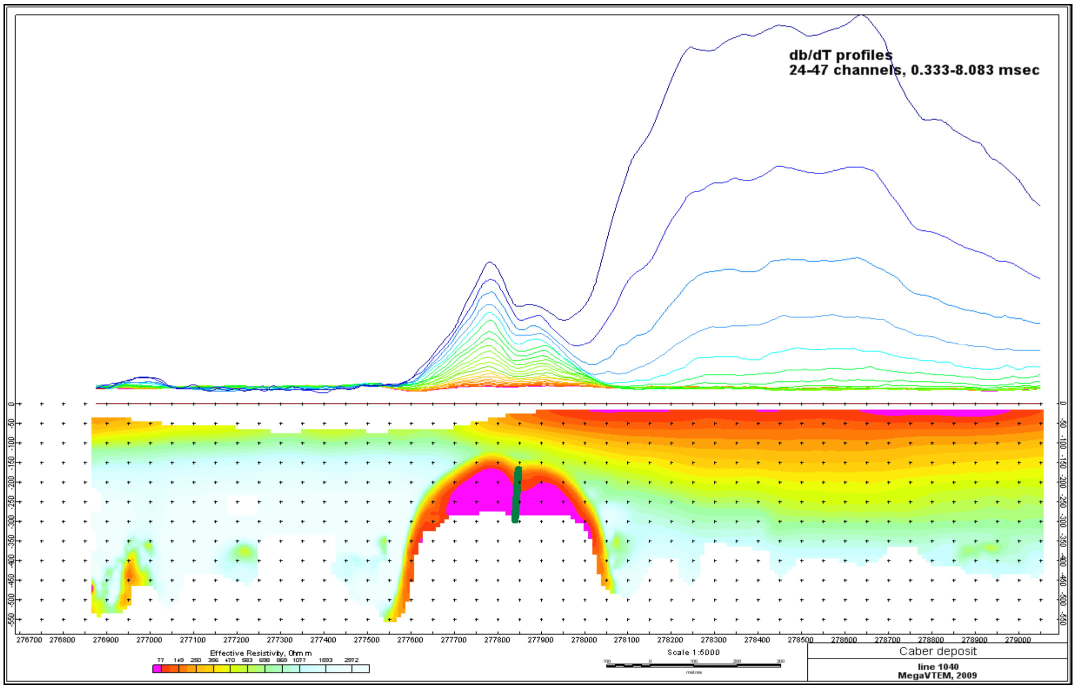
3d views of apparent resistivity depth slices



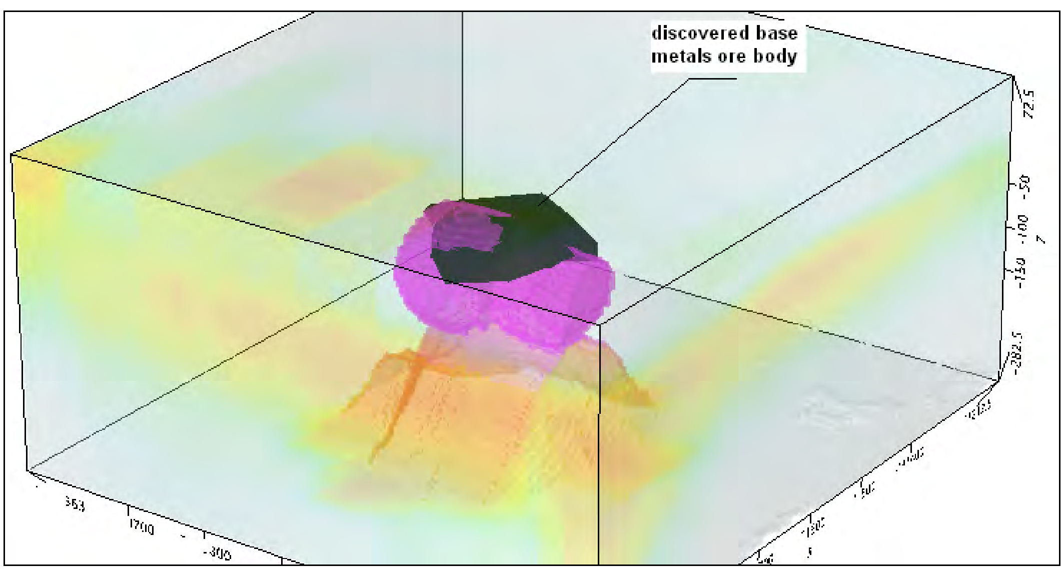


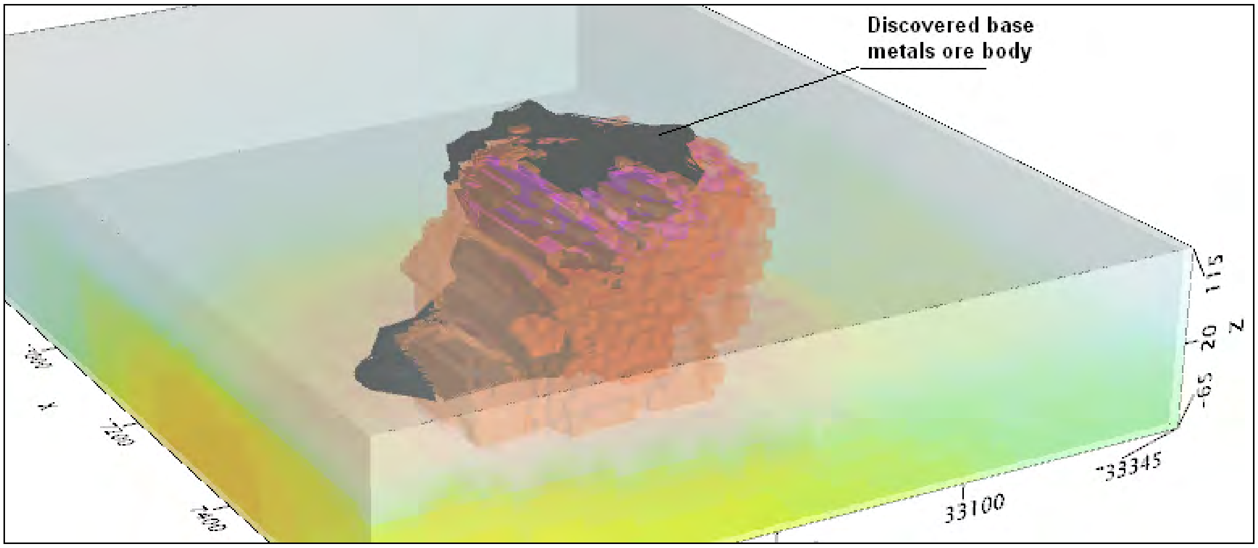
Real base metal targets in comparison with RDIs:

RDI section of the line over Caber deposit ("thin" subvertical plate target and conductive overburden.



3d RDI voxels with base metals ore bodies (Middle East):





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Geotech Ltd.
April 2011

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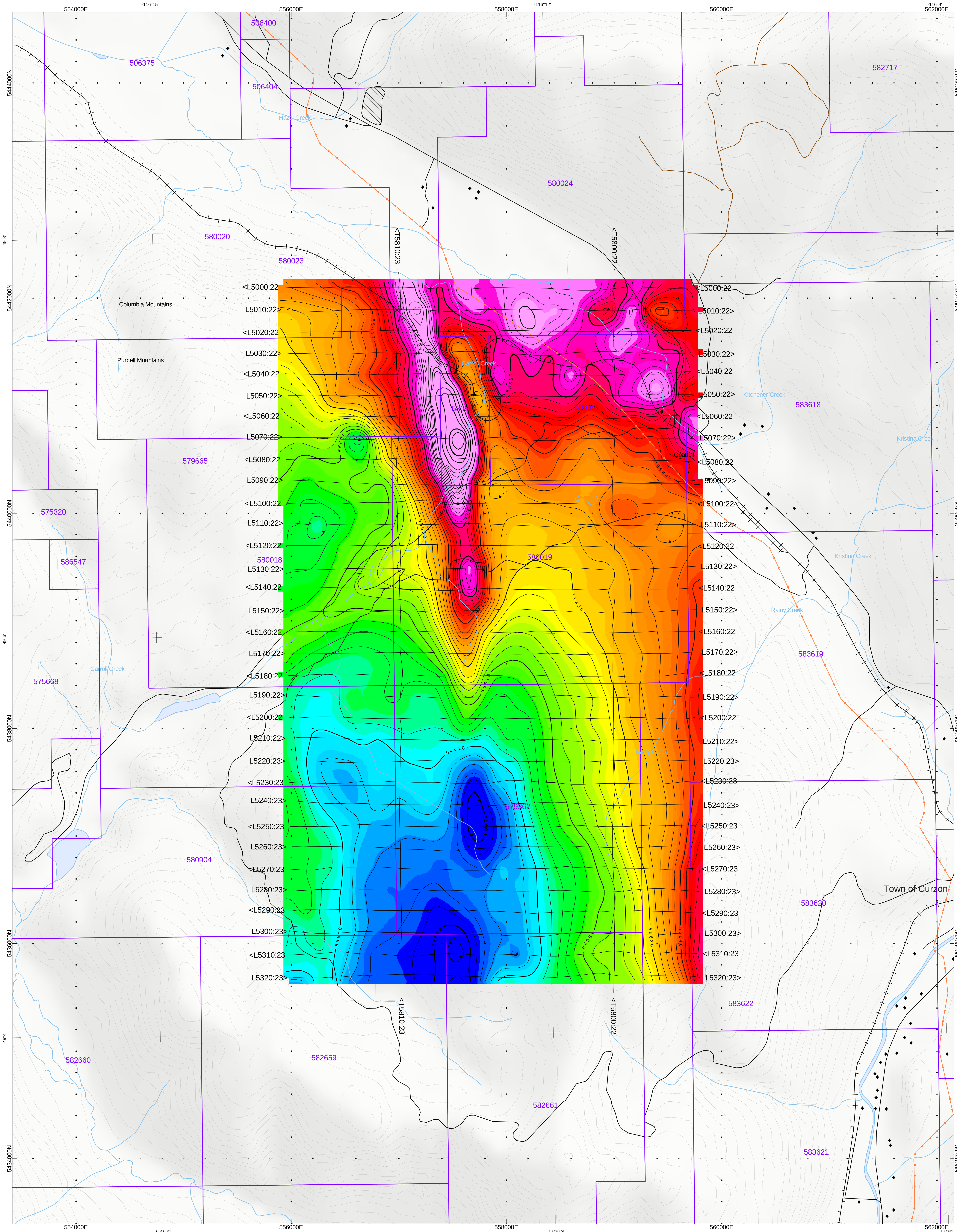

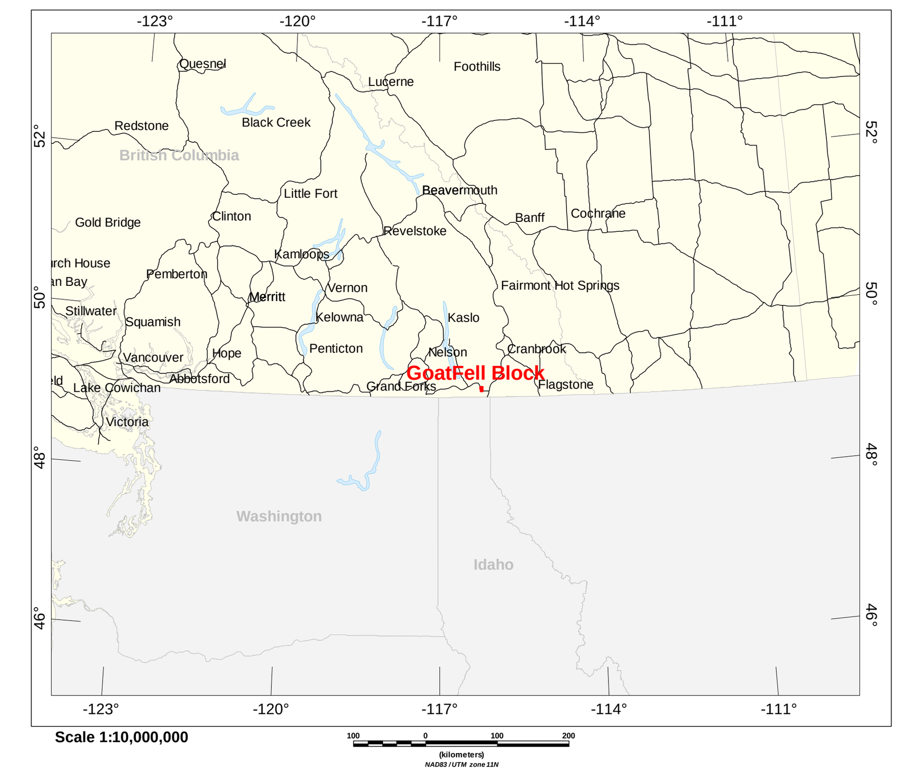

SURVEY SPECIFICATIONS:
- Survey Date: October 19th 2011
- Survey Base: Crawford Bay, British Columbia
- Aircraft: Aerospatiale A-Star 350 B3 (C-GABH)
- Nominal Survey Line Spacing: 200 Meters
- Nominal Survey Line Direction: N 90° E / N 270° E
- Nominal Tie Line Spacing: 2000 Meters
- Nominal Tie Line Direction: N 0° E / N 180° E
- Nominal Terrain Clearance: 117 Meters
- EM Loop: Towed at a mean distance of 35 meters below the Helicopter
- Magnetic Sensor: Towed at a mean distance of 13 meters below the Helicopter

INSTRUMENTS
- Geotech Time Domain Electromagnetic System (VTEM)
- Concentric Rx/Tx Geometry
- Transmitter Loop: Diameter 26 Meters,Base Frequency 30 Hz
- Dipole Moment: 339,794 nIA
- Transmitter Wave Form: Trapezoid, Pulse Width 7.14 ms.
- Geometrics High Sensitivity Cesium Magnetometer
- Mag Resolution: 0.02 nT at 10 samples/sec

MAP PROJECTION
- Datum: NAD 83
- Projection: Universal Transverse Mercator
- Central Meridian: 117°W (Zone 11N)
- Central Scale Factor: 0.9996
- False Easting/Northing: 500,000m/0m
- Major Axis: 6378137.000
- Eccentricity: 0.081819191
- NTS: 082F01

TOPOGRAPHIC LEGEND:
- Buildings
- Railroads
- Pipelines
- Trans Lines
- Roads
- Trails
- Streams / Rivers
- Contours
- Lakes / Ponds
- Wetlands
- Mining Areas
- Mining Claims

TMI Contour Intervals:
- 10 nT
- 50 nT
- 250 nT

55659
55655
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55639
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55615
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55609
55607
55606
55605
55603

TMI
(nT)

Scale 1:20000

250 0 250 500 750 1000
(meters)
NAD83 / UTM zone 11N

The topographic data base was derived from 1:50000 NRC (Natural Resources Canada) NTDB data
Background shading is derived from NASA SRTM (Shuttle Radar Topography Mission) data
Inset data derived from Geocommunities 1:250,000 Canadian National Topographic database
Mining Claims are derived from the British Columbia Ministry of Energy and Mines
(www.geocomm.com)(www.geogratis.ca)(http://www.empr.gov.bc.ca)

TerraLogic Exploration Services
Goatfell Block
Crawford Bay, British Columbia

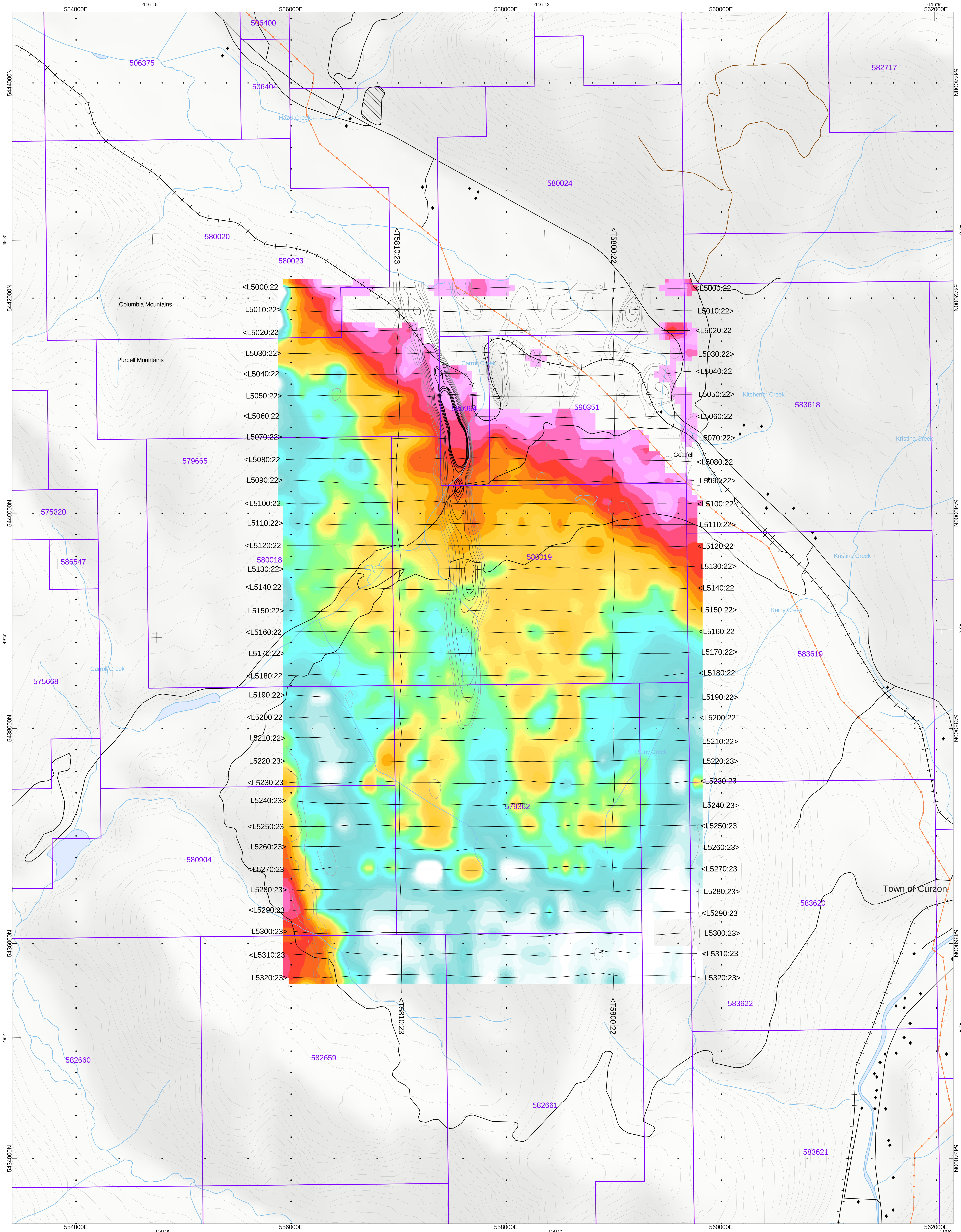
Geotech VTEM System
VTEM Total Magnetic Intensity
(TMI)

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

November 2011

Geotech Project # 11175

GEOTECH LTD.



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CVG Contour Intervals:

- 0.0075 nT/m
- 0.0500 nT/m
- 0.2500 nT/m

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- Buildings
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0.500
0.357
0.315
0.268
0.217
0.176
0.146
0.128
0.112
0.100
0.093
0.087
0.084
0.081
0.078
0.076
0.074
0.072
0.071
0.069
0.067
0.066
0.064
0.062
0.060
0.059
0.057
0.055
0.052
0.050
0.047
0.044
0.041
0.039
0.036
0.034
0.032
0.030
0.028
0.000

TAU dB/dT
msec

Scale 1:20000

250 0 250 500 750 1000
(meters)
NAD83 / UTM zone 11N

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TerraLogic Exploration Services
Goatfell Block
Crawford Bay, British Columbia

Geotech VTEM System
dB/dt Calculated Time Constant (TAU) with CVG contours calculated from TMI

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

November 2011

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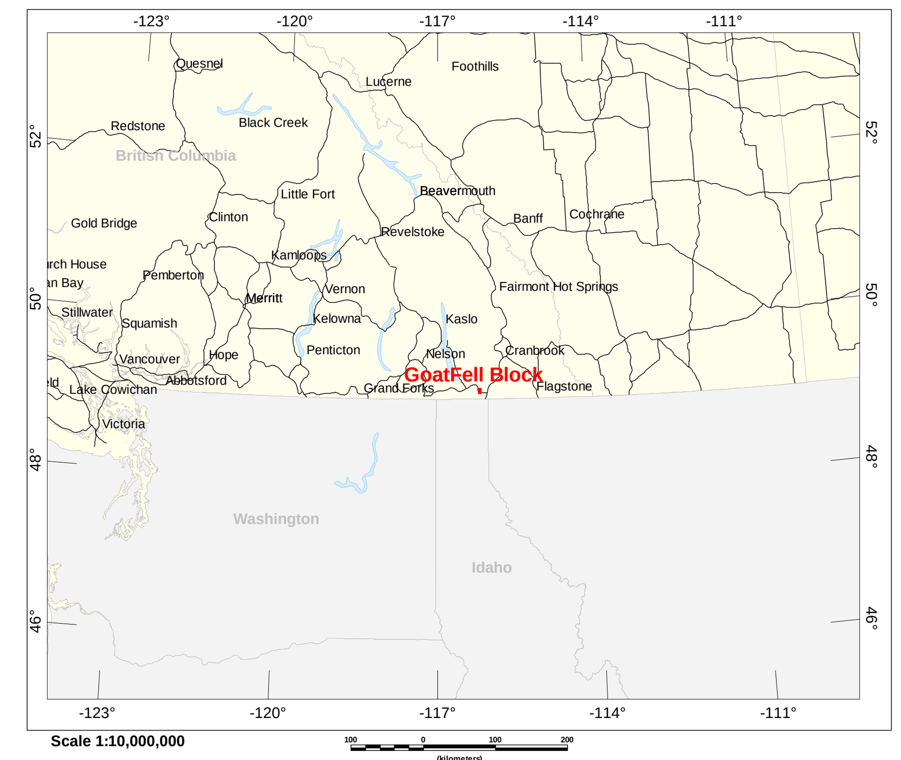
GEOTECH LTD.



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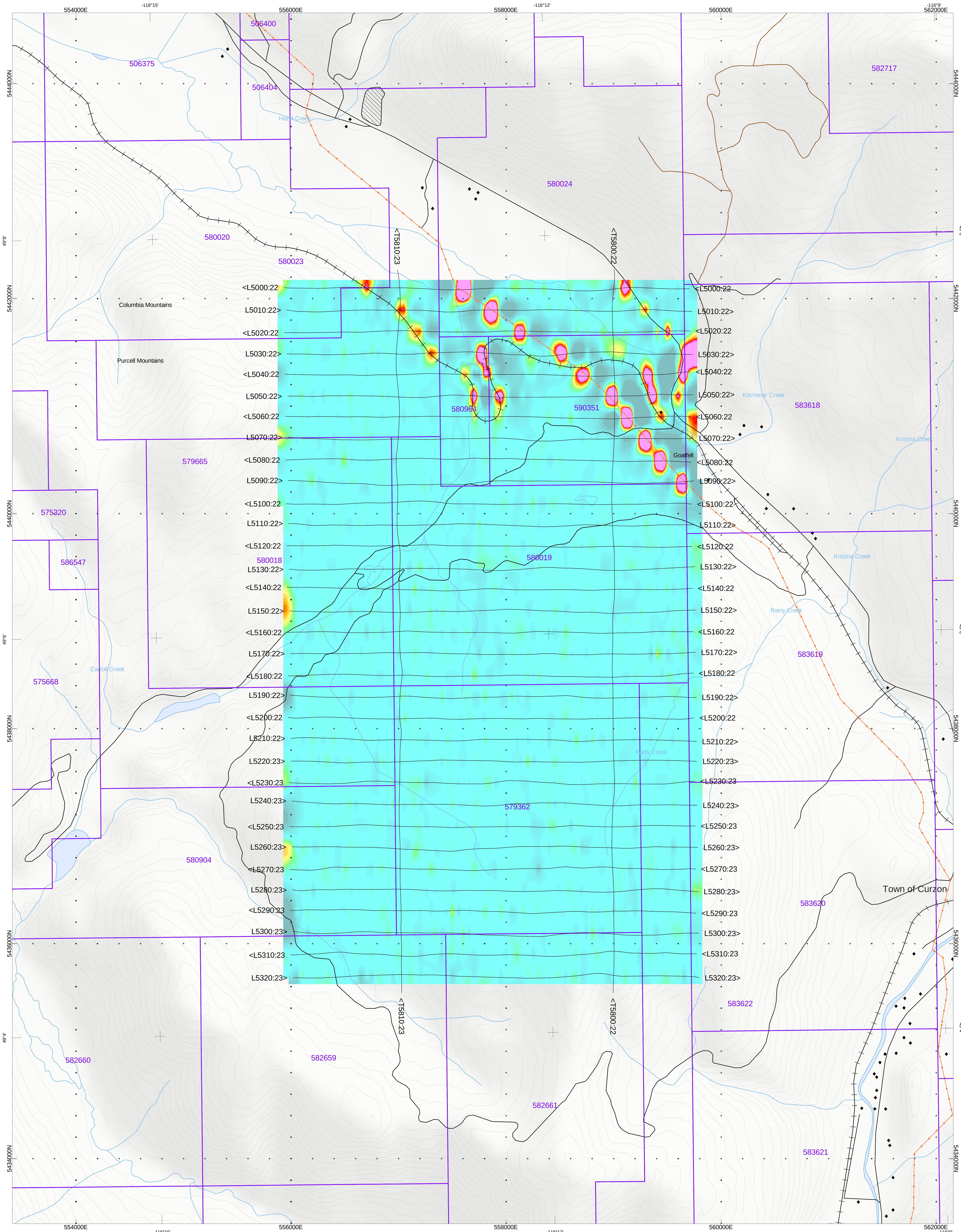

TOPOGRAPHIC LEGEND:

- Buildings
- Railroads
- Pipelines
- Trans Lines
- Roads
- Trails
- Streams / Rivers
- Contours
- Lakes / Ponds
- Wetlands
- Mining Areas
- Mining Claims

0.0128
0.0112
0.0102
0.0093
0.0086
0.0081
0.0076
0.0071
0.0067
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0.0005
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-0.0011
-0.0016
-0.0021
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-0.0033
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SFxFF
(pV/A*m4)

Scale 1:20000

250 0 250 500 750 1000
(meters)
NAD83 / UTM zone 11N

The topographic data base was derived from 1:50000 NRC (Natural Resources Canada) NTDB data
Background shading is derived from NASA SRTM (Shuttle Radar Topography Mission) data
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TerraLogic Exploration Services
Goatfell Block
Crawford Bay, British Columbia

Geotech VTEM System
Fraser Filtered dB/dt X Component
Channel 20, Time Gate 0.220 ms

Flown and processed by Geotech Ltd.
245 Industrial Parkway North,
Aurora, Ontario, Canada L4G 4C4
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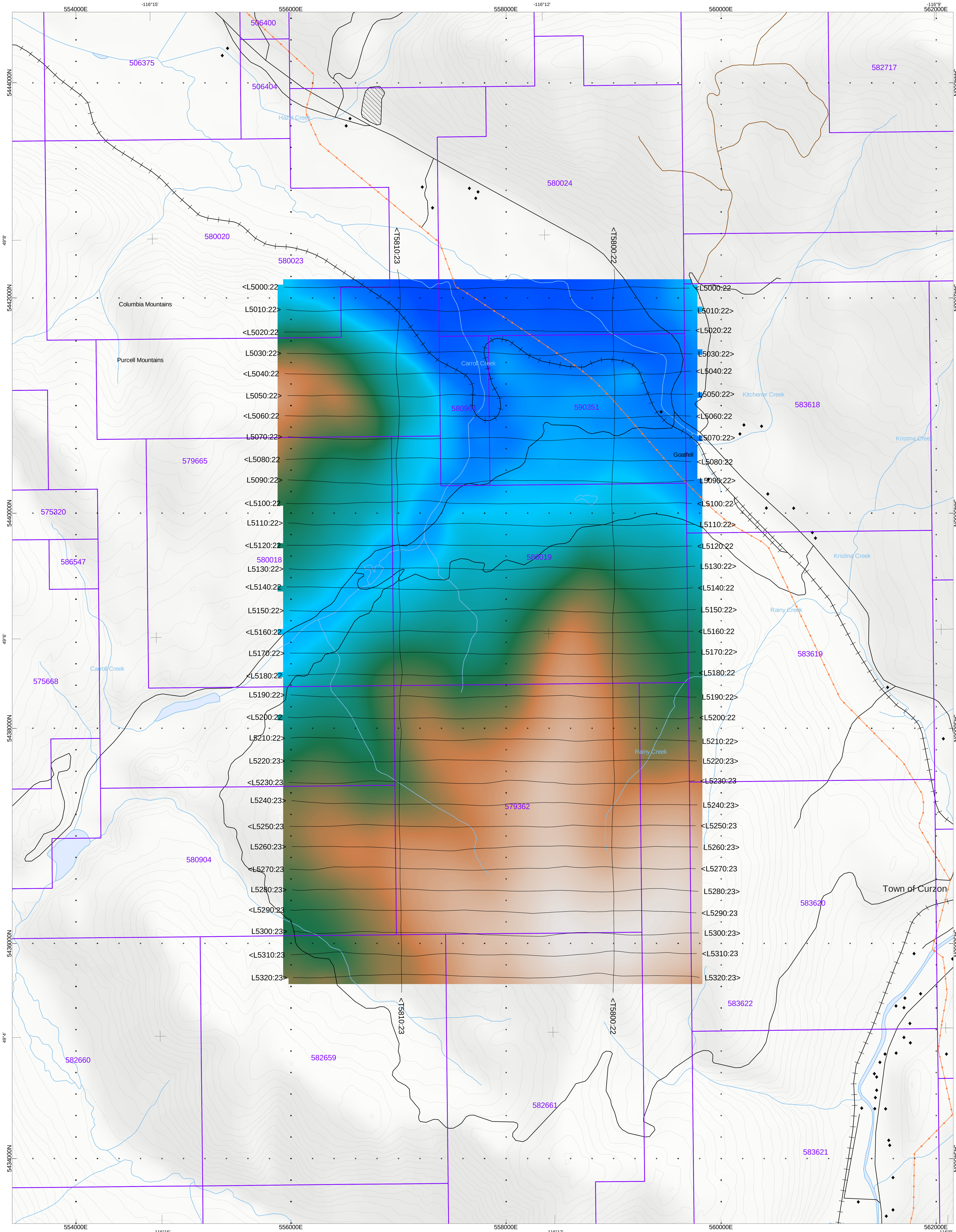
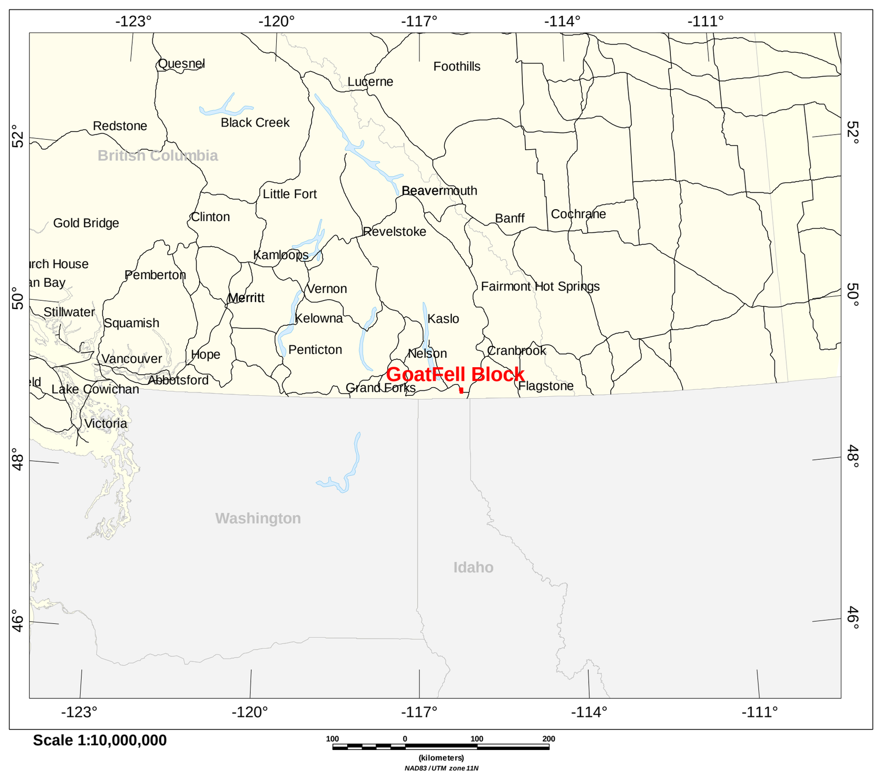
November 2011

Geotech Project # 11175

GEOTECH LTD.





SURVEY SPECIFICATIONS:
- Survey Date: October 19th 2011
- Survey Base: Crawford Bay, British Columbia
- Aircraft: Aerospatiale A-Star 350 B3 (C-GABH)
- Nominal Survey Line Spacing: 200 Meters
- Nominal Survey Line Direction: N 90° E / N 270° E
- Nominal Tie Line Spacing: 2000 Meters
- Nominal Tie Line Direction: N 0° E / N 180° E
- Nominal Terrain Clearance: 117 Meters
- EM Loop: Towed at a mean distance of 35 meters below the Helicopter
- Magnetic Sensor: Towed at a mean distance of 13 meters below the Helicopter

INSTRUMENTS
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- Concentric Rx/Tx Geometry
- Transmitter Loop: Diameter 26 Meters,Base Frequency 30 Hz
- Dipole Moment: 339,794 nIA
- Transmitter Wave Form: Trapezoid, Pulse Width 7.14 ms.
- Geometrics High Sensitivity Cesium Magnetometer
- Mag Resolution: 0.02 nT at 10 samples/sec

MAP PROJECTION
- Datum: NAD 83
- Projection: Universal Transverse Mercator
- Central Meridian: 117°W (Zone 11N)
- Central Scale Factor: 0.9996
- False Easting/Northing: 500,000m/0m
- Major Axis: 6378137.000
- Eccentricity: 0.081819191
- NTS: 082F01

TOPOGRAPHIC LEGEND:
- Buildings
- Railroads
- Pipelines
- Trans Lines
- Roads
- Trails
- Streams / Rivers
- Contours
- Lakes / Ponds
- Wetlands
- Mining Areas
- Mining Claims

DEM
(metres)

Scale 1:20000

250 0 250 500 750 1000

(meters)

NAD83 / UTM zone 11N

The topographic data base was derived from 1:50000 NRC (Natural Resources Canada) NTDB data
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Mining Claims are derived from the British Columbia Ministry of Energy and Mines
(www.geocomm.com)(www.geogratis.ca)(http://www.empr.gov.bc.ca)

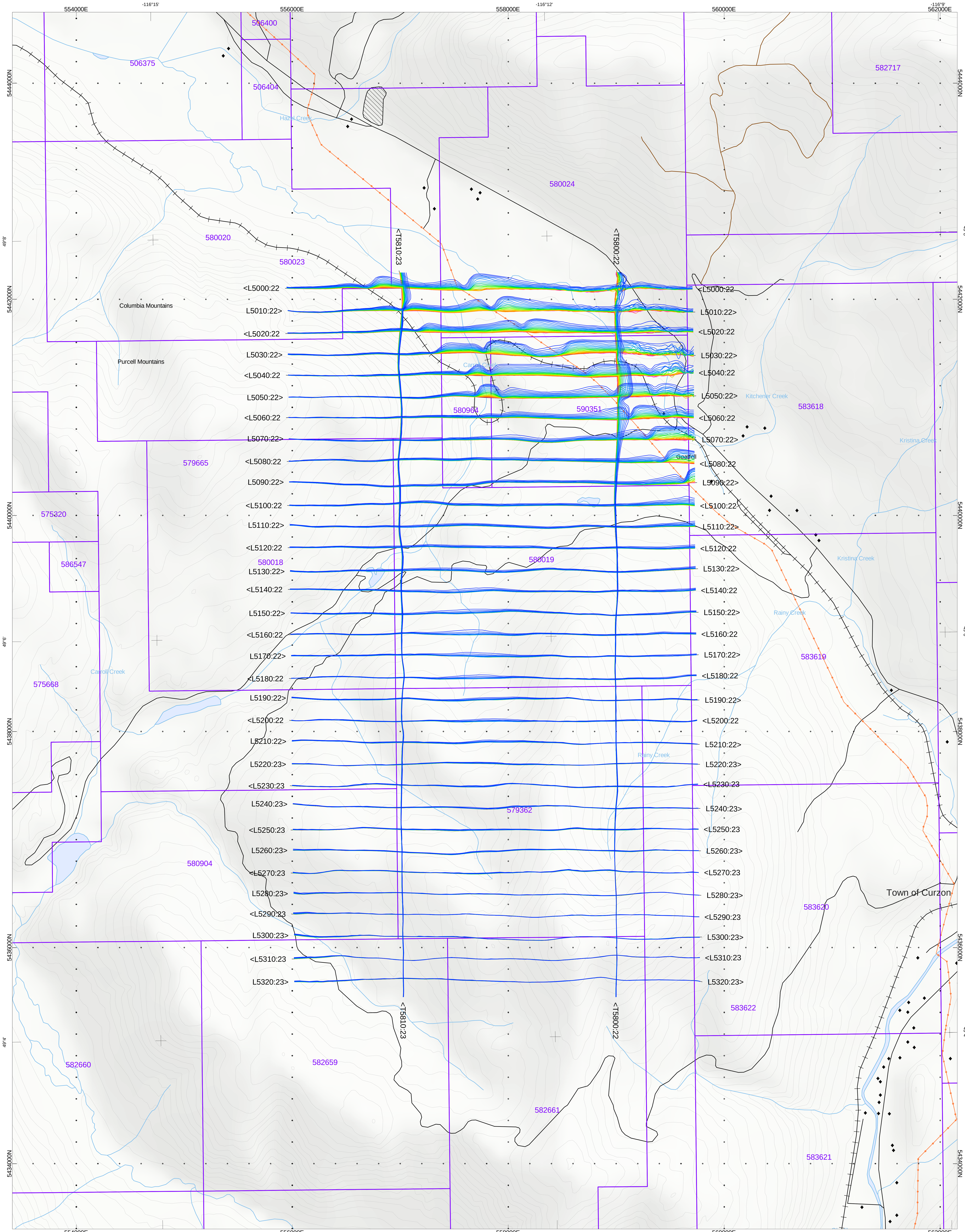
TerraLogic Exploration Services
Goatfell Block
Crawford Bay, British Columbia

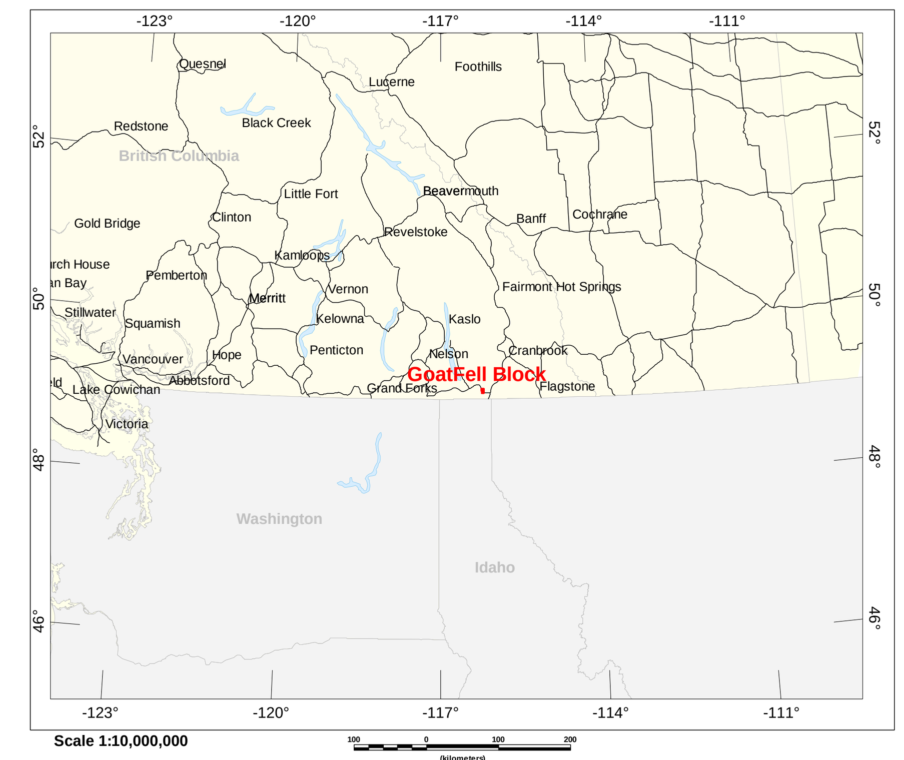
Geotech VTEM System
Digital Elevation Model
(DEM)

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

November 2011

Geotech Project # 11175





GEOTECH LTD.

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Profiles scale 1 mm = 0.05 (pV/A*m^4)
Linear between +/-0.25 (pV/A*m^4)
logarithmic above 0.25 (pV/A*m^4)

0.220 ms
0.253 ms
0.290 ms
0.333 ms
0.383 ms
0.440 ms
0.505 ms
0.580 ms
0.667 ms
0.766 ms
0.880 ms
1.010 ms
1.161 ms
1.333 ms
1.531 ms
1.760 ms
2.021 ms
2.323 ms
2.667 ms
3.063 ms
3.521 ms
4.042 ms
4.641 ms
5.333 ms
6.125 ms
7.036 ms

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Buildings
Railroads
Pipelines
Trans Lines
Roads
Trails
Streams / Rivers
Contours
Lakes / Ponds
Wetlands
Mining Areas
Mining Claims

Scale 1:20000
250 0 250 500 750 1000
(meters)
NAD83 / UTM zone 11N

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TerraLogic Exploration Services
Goatfell Block
Crawford Bay, British Columbia

Geotech VTEM System
VTEM dB/dt Z Component Profiles
Time Gates 0.220 - 7.036 ms

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

November 2011

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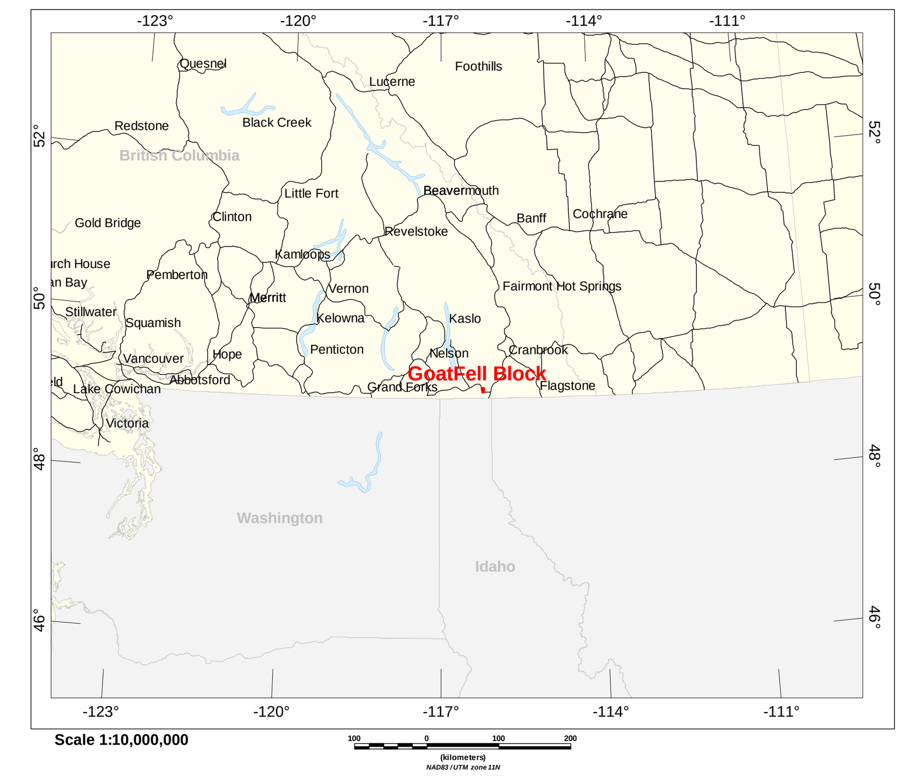
GEOTECH LTD.



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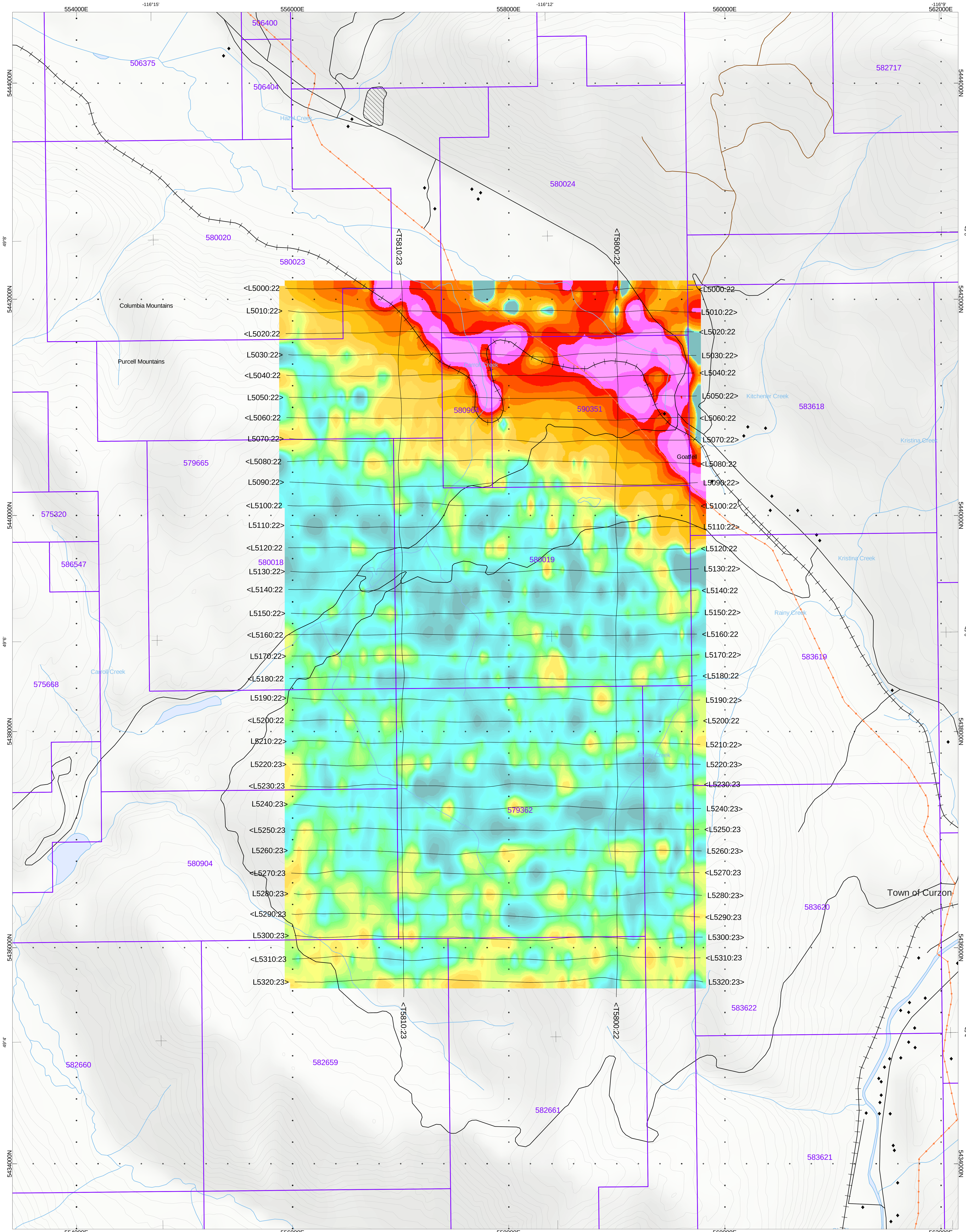

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- Mining Claims

Bfz36
(pV*ms)/(A*m^4)

Scale 1:20000
(meters)
NAD83 / UTM zone 11N

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TerraLogic Exploration Services
Goatfell Block
Crawford Bay, British Columbia

Geotech VTEM System
VTEM B-Field Z Component
Channel 36, Time Gate 2.021 ms

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

November 2011

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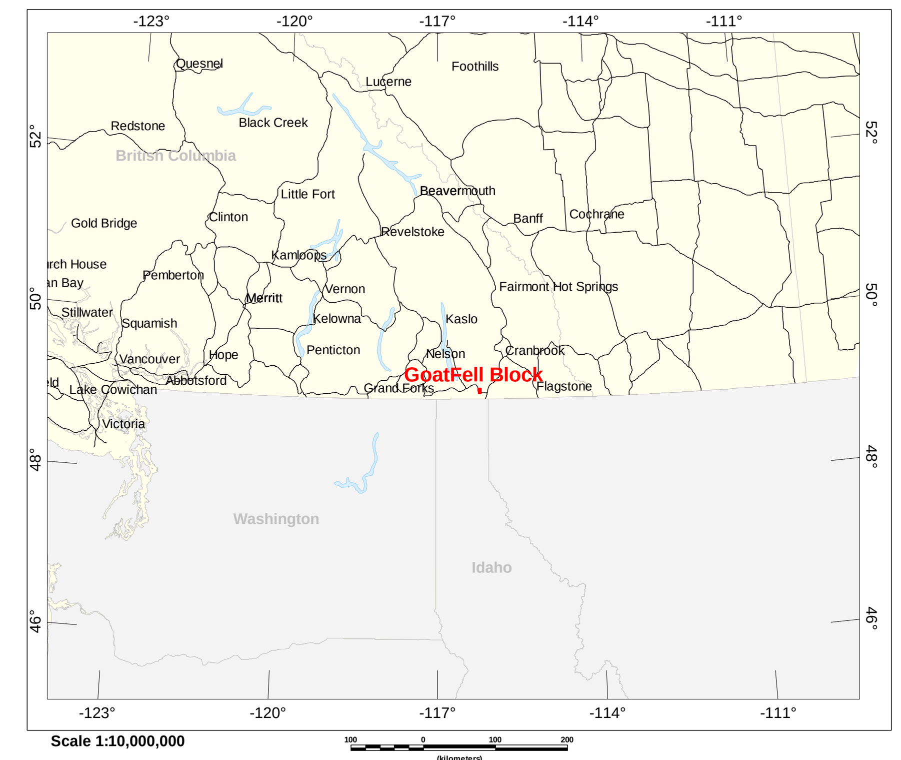
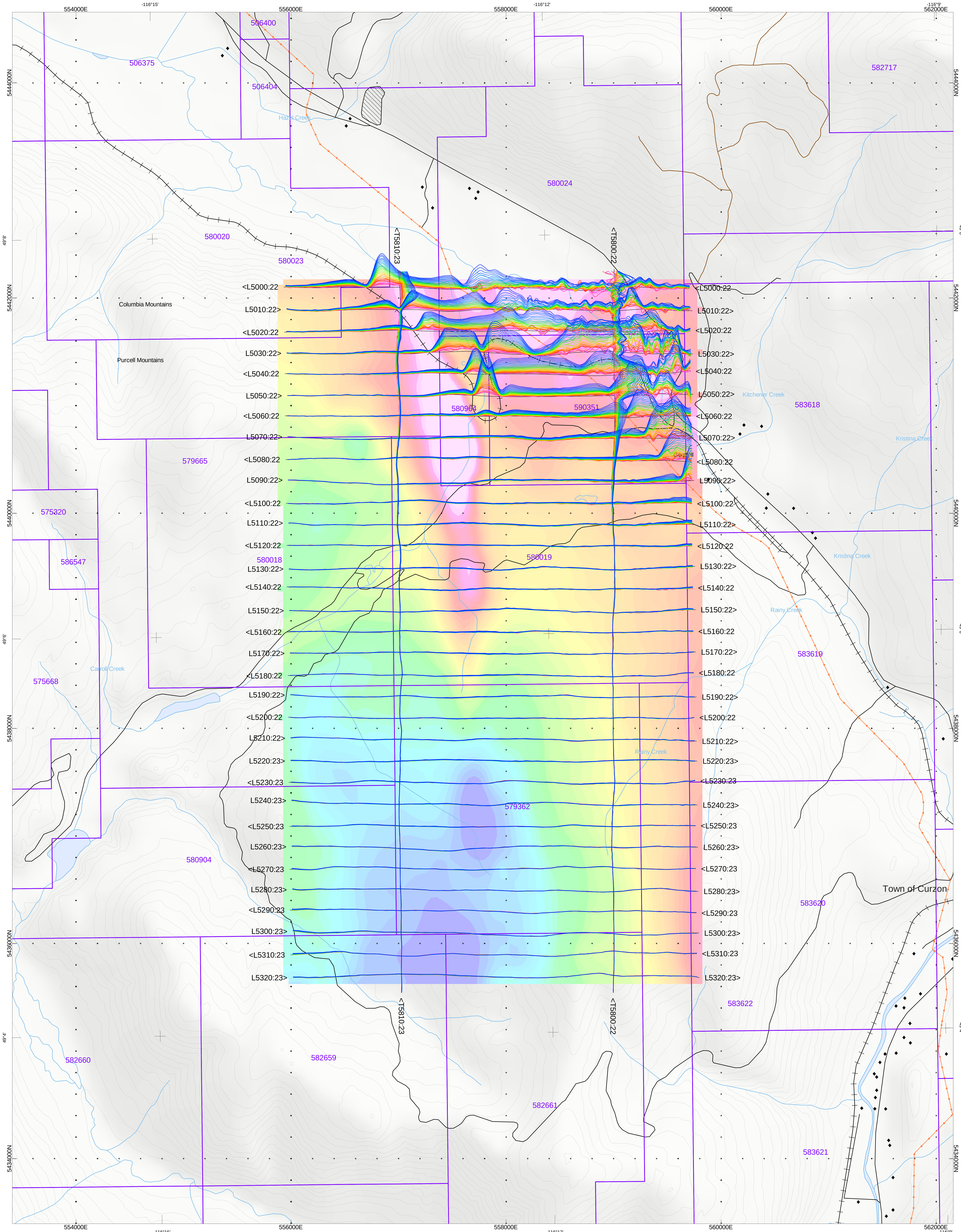
GEOTECH LTD.





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Profiles scale 1 mm = 0.015 (pV*ms)/(A*m^4)

(Linear between +/-0.5 (pV*ms)/(A*m^4) logarithmic above 0.5 (pV*ms)/(A*m^4)

0.220 ms (B-field)
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5.333 ms (B-field)
6.125 ms (B-field)
7.036 ms (B-field)

TMI (nT): 55659, 55655, 55652, 55650, 55648, 55645, 55643, 55641, 55639, 55638, 55637, 55636, 55636, 55634, 55633, 55632, 55631, 55630, 55629, 55627, 55625, 55624, 55622, 55620, 55619, 55618, 55617, 55615, 55614, 55613, 55612, 55611, 55610, 55609, 55607, 55606, 55605, 55603

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Goatfell Block
Crawford Bay, British Columbia

Geotech VTEM System
VTEM B-Field Z Component Profiles
Time Gates 0.220 - 7.036 ms
Over Total Magnetic Intensity (TMI)

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

November 2011

Geotech Project # 11175

Appendix IV

Fugro Airborne Suvey's Logistics Report

Creston Area, British Columbia

HeliFALCON™ Airborne Gravity Gradiometer Survey

for

TerraLogic Exploration Inc.

Logistics and Processing Report

Survey Flown: Oct to Dec, 2011

By

FUGRO AIRBORNE SURVEYS CORP
U3/435 Scarborough Beach Road
Osborne Park, WA, 6017
AUSTRALIA
2505 Meadowvale Blvd.
Mississauga, Ontario, L5N 5S2
CANADA

Project# 11054

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FIGURES

TABLES

1 INTRODUCTION

Fugro Airborne Surveys conducted a high-sensitivity aeromagnetic and **HeliFALCON™** Airborne Gravity Gradiometer (AGG) survey over Goatfell survey area under contract with TerraLogic Exploration Inc.

1.1 Survey Location

The Goatfell survey area are centred on longitude 116° 19' W, latitude 49º 24' N (see the location map in *Figure 1*).

The production flights took place from October to December 2011 with the first production flight taking place on October 25th and the final flight taking place on December 1st. To complete the survey area coverage a total of 29 production flights were flown, for a combined total of 1889 line kilometres of data acquired.

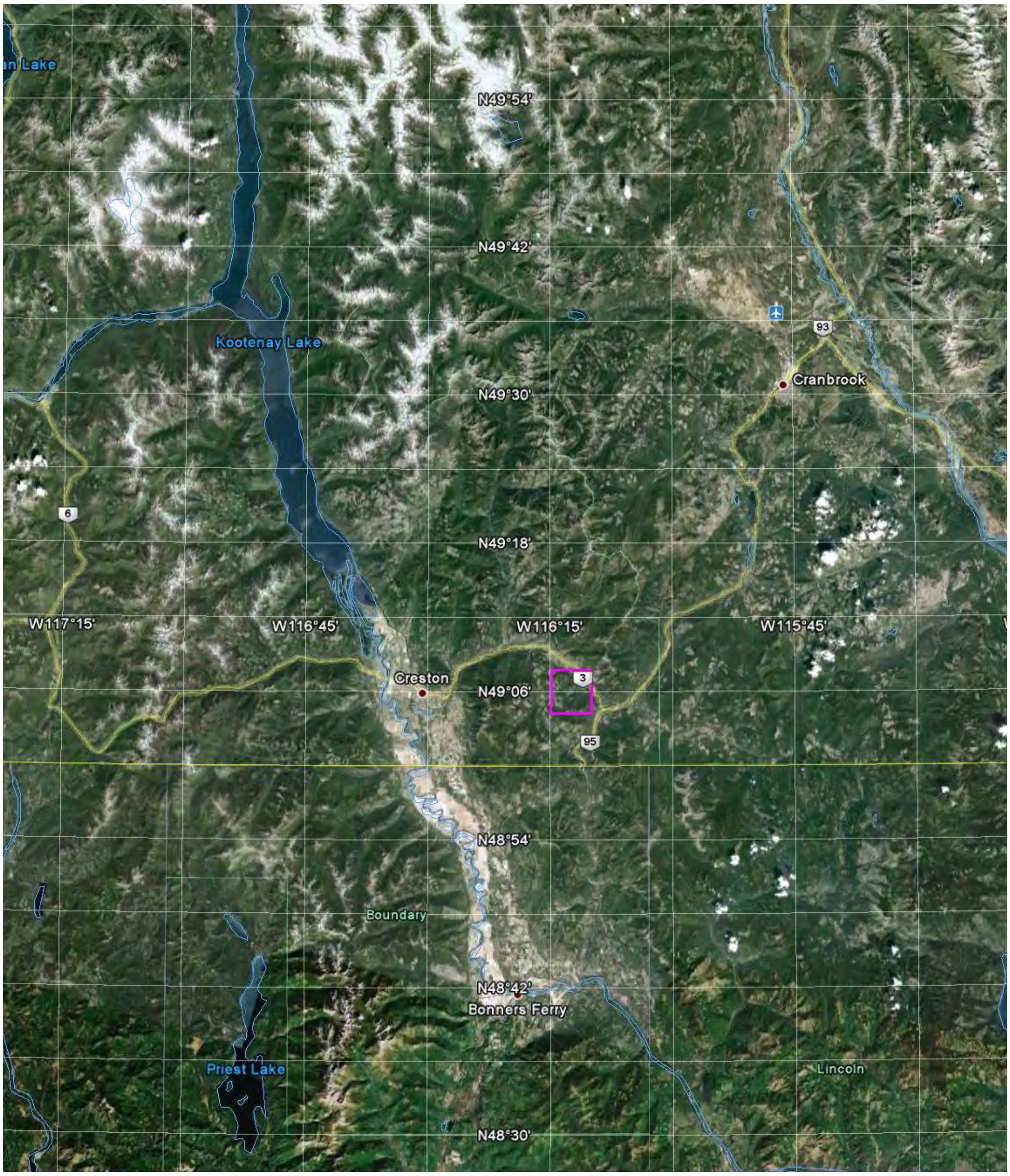

Figure 1: Creston Area, BC – ***Survey Area Location***

1.2 General Disclaimer

It is Fugro Airborne Survey's understanding that the data and report provided to the client is to be used for the purpose agreed between the parties. That purpose was a significant factor in determining the scope and level of the Services being offered to the Client. Should the purpose for which the data and report is used change, the data and report may no longer be valid or appropriate and any further use of, or reliance upon, the data and report in those circumstances by the Client without Fugro Airborne Survey's review and advice shall be at the Client's own or sole risk.

The Services were performed by Fugro Airborne Survey exclusively for the purposes of the Client. Should the data and report be made available in whole or part to any third party, and such party relies thereon, that party does so wholly at its own and sole risk and Fugro Airborne Survey disclaims any liability to such party.

Where the Services have involved Fugro Airborne Survey's use of any information provided by the Client or third parties, upon which Fugro Airborne Survey was reasonably entitled to rely, then the Services are limited by the accuracy of such information. Fugro Airborne Survey is not liable for any inaccuracies (including any incompleteness) in the said information, save as otherwise provided in the terms of the contract between the Client and Fugro Airborne Survey.

2 SUMMARY OF SURVEY PARAMETERS

2.1 Survey Area Specifications

Goatfell

Total Kilometres (km)	221
Minimum Drape Height (m)	30
Clearance Method	Drape
Traverse Line Direction (deg.)	90 / 270
Traverse Line Spacing (m)	200
Tie Line Direction (deg.)	0 / 180
Tie Line Spacing (m)	2000

The survey block is defined by the coordinates in *Table 1,* in UTM Zone 11N projection, referenced to the WGS84 datum.

Corner Number	Easting	Northing
1	554898	5442132
2	560898	5442132
3	560898	5435609
4	554898	5435609

Table 1: Goatfell – *Survey Boundary Coordinates*

2.2 Data Recording

The following parameters were recorded during the course of the survey:

- **HeliFALCON™ AGG data:** recorded at different intervals.
- **Aircraft altitude:** measured by the barometric altimeter at intervals of 0.1 s.
- **Terrain clearance:** provided by the radar altimeter at intervals of 0.1 s.
- **Airborne GPS positional data** (latitude, longitude, height, time and raw range from each satellite being tracked): recorded at intervals of 1 s.
- **Time markers:** in digital data.
- **Ground total magnetic field:** recorded with a 1 s sampling rate.
- **Ground based GPS positional data** (latitude, longitude, height, time and raw range from each satellite being tracked): recorded at intervals of 1 s.
- **Aircraft distance to ground:** measured by two laser scanners, scanning at 20 times per second (when in range of the instrument and in the absence of thick vegetation).

2.3 Job Safety Plan, HSE Summary

A Job Safety Plan and Job Safety Analysis was prepared and implemented in accordance with the Fugro Airborne Surveys Occupational Safety and Health Management System.

3 FIELD OPERATIONS

3.1 Operations

The survey was based out of Creston, BC. The survey aircraft was operated from **Creston Valley Airport** using aircraft fuel available on site. A temporary office was set up in Creston, BC, where all survey operations were run and the post-flight data verification was performed.

3.2 Base Stations

A dual frequency GPS base station was set up close to Creston airport runway in order to correct the raw GPS data collected in the aircraft. A secondary GPS base station was available close to the primary GPS base but was not required.

GPS Base Station

Valid for Flights FLT001 to FLT028

Date:	October 24 to November 14, 2011
Location:	Creston Valley Airport, BC
Latitude:	49 02 11.7531N
Longitude:	116 29 44.3645W
Height:	618.205 m ellipsoidal

Valid for Flights FLT029 to FLT041

Date:	November 14 to 27, 2011
Location:	Creston Valley Airport, BC
Latitude:	49 02 11.7537N
Longitude:	116 29 44.3642W
Height:	618.194m ellipsoidal

3.3 Field Personnel

The following technical personnel participated in field operations:

Crew Leader:	Eric Roen
Pilots:	Glenn Charbonneau, Daniel Ragan, Shanne Kochan
Technicians:	Burke Schieman, Devon Watson and Logan Streun
Project Manager:	Adriana Pagliero
Final QC and Processing:	A. Carbone and P. Chambers

4 QUALITY CONTROL RESULTS

4.1 Survey acquisition issues

During the course of the survey there were no data quality issues with:

AGG instrumentation
GPS base stations
Data acquisition systems
Radar altimeter
Laser scanner

Wind gust knocked over primary GPS base station and after reinstalling a new masterpoint was determined and used for processing the flights from FLT029 to FLT041.

4.2 Flight Path Map

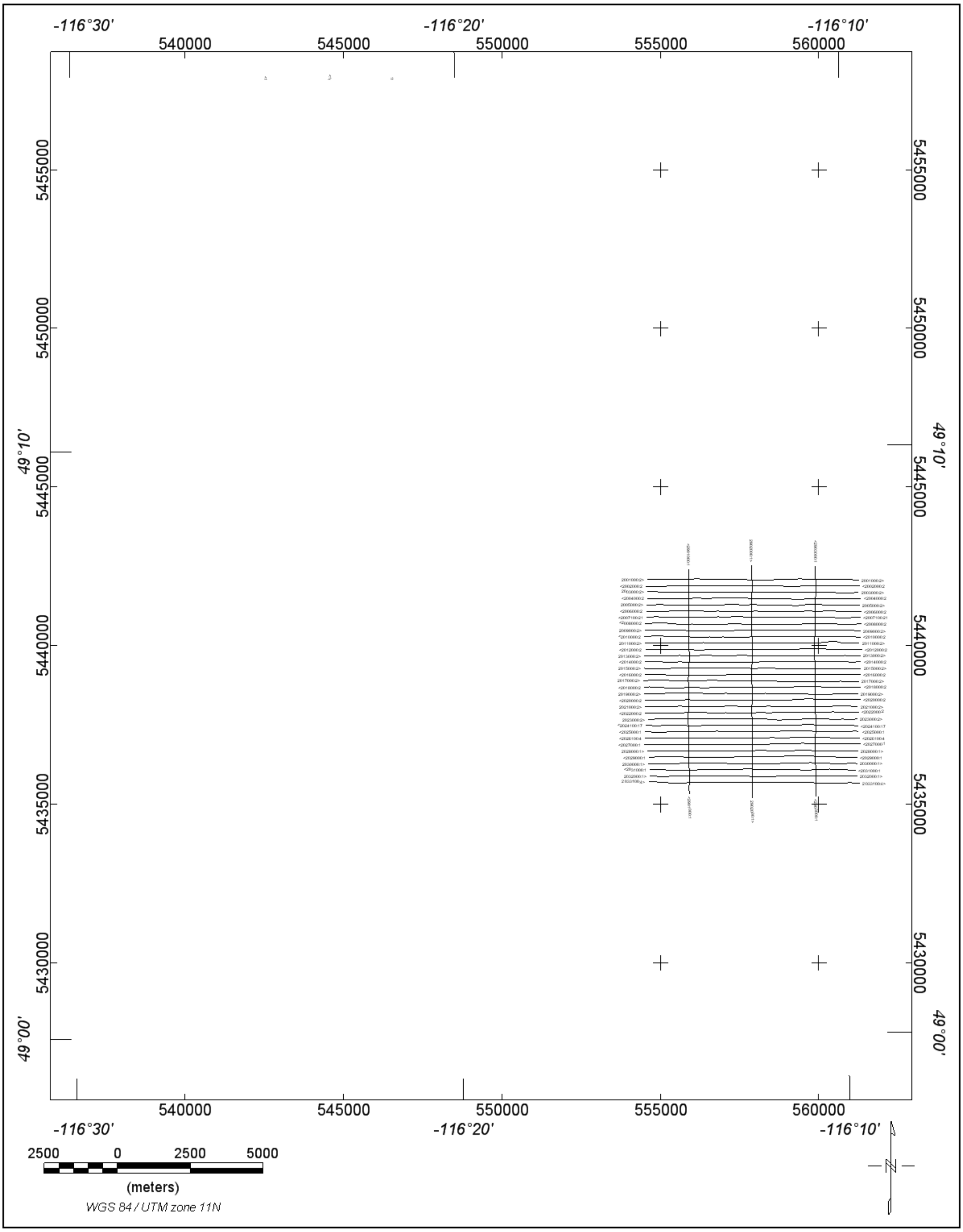

Figure 2: Goatfell – *Flight Path map*

4.3 Turbulence

The mean turbulence recorded across the survey areas were 14.6 milli g (where g = 9.80665 m/sec/sec). Turbulence was typically very low throughout most of the job and the most variation occurred with large changes in altitude. The turbulence pattern across the survey area is shown in *Figure 3*.

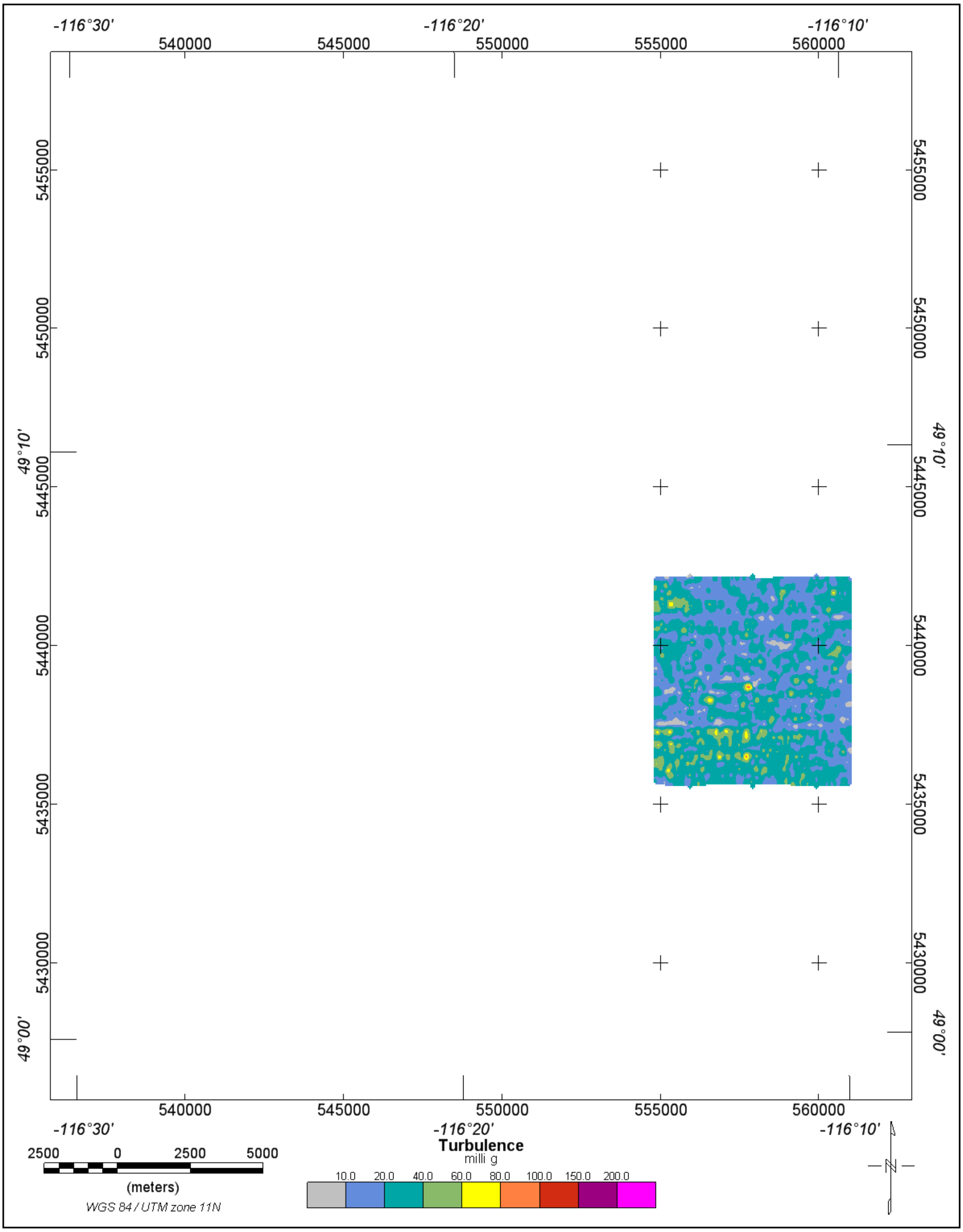

Figure 3: Goatfell – *Turbulence (milli g where g = 9.80665 m/sec/sec)*

4.4 AGG System Noise

The system noise is defined to be the standard deviation of half the difference between the A & B complements, for each of the NE and UV curvature components. The results for this survey were very good with values of 2.47 E and 2.47 E for NE and UV respectively.

1. *Figure 4, 5* provide a representation of the variation in this standard deviation for each component. This is achieved by gridding a rolling measurement of standard deviation along each line using a window length of 100 data points.

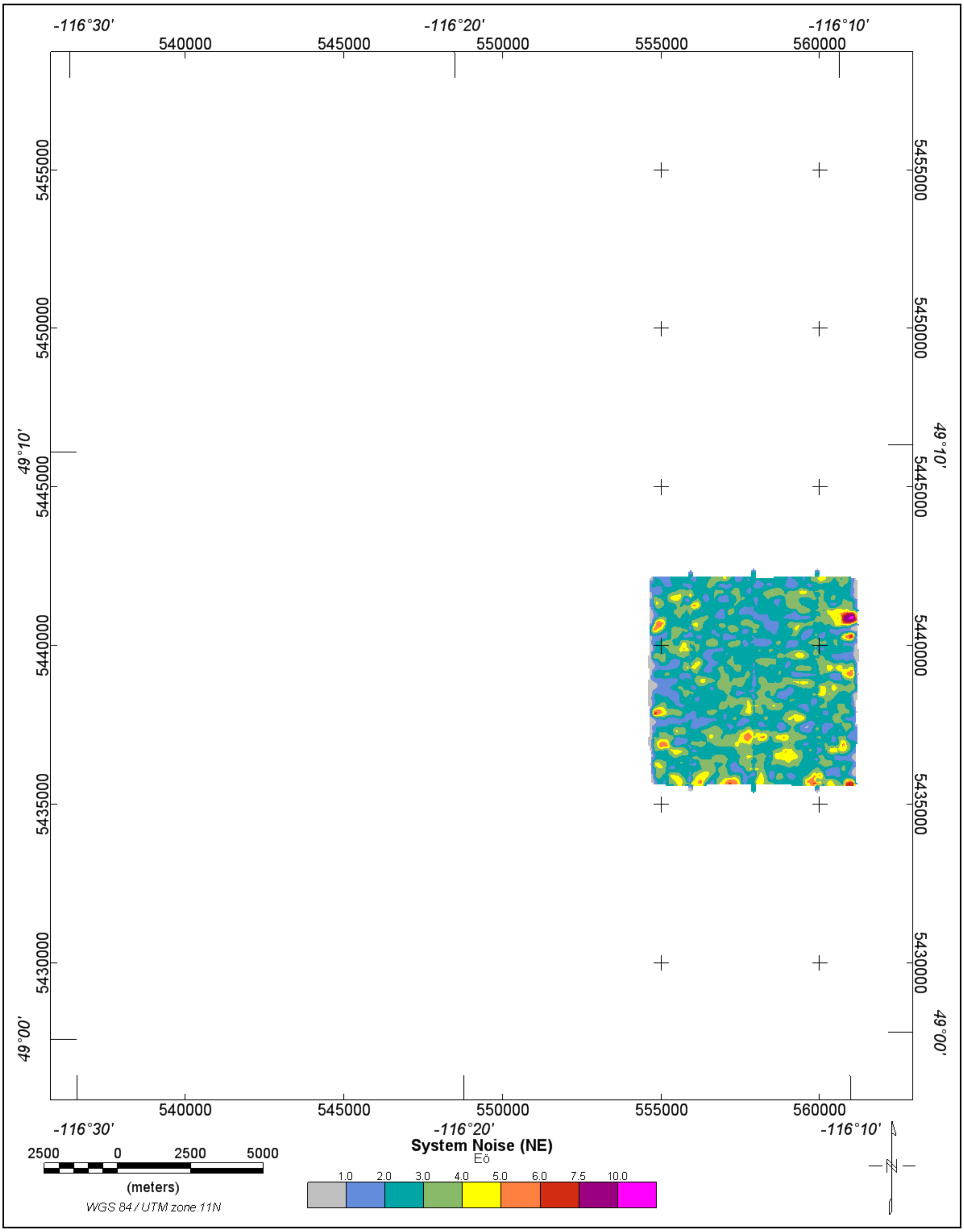

Figure 4: Goatfell – *System Noise NE (*E)

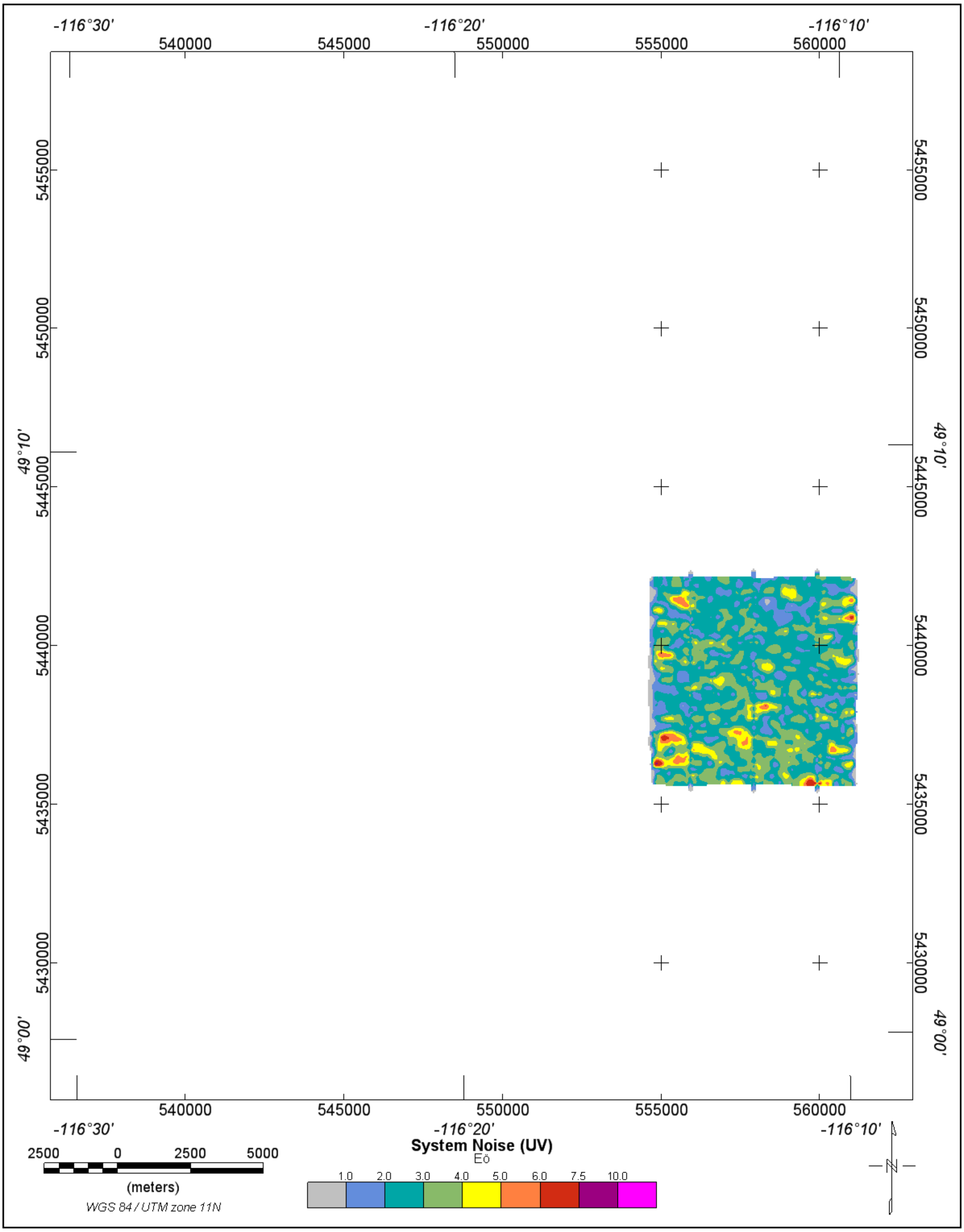

Figure 5: Goatfell – *System Noise UV (*E)

4.5 Digital Terrain Model

Laser scanner range data were combined with GPS position and height data (adjusted from height above the WGS84 ellipsoid to height above the geoid by applying the Earth Gravitational Model 1996 (EGM96)). The outputs of this process are two "swaths" of terrain elevations extending either side of the aircraft flight path. Width and sample density of this swath varies with aircraft height. Typical values are 100 to 150 metres and 5 to 10 metres respectively.

Because terrain correction of AGG data requires knowledge of the terrain at distances up to at least 10 km from the data location, laser scanner data collected only along the survey line path must be supplemented by data from another source. For this purpose, Shuttle Radar Topography Mission (SRTM) v2 data are usually chosen. If available, high resolution (one arc second) data are used.

Laser scanner data quality was very good with scan density generally above 90%. Laser scanner data were gridded at 10 m with a 1 cell maximum extension beyond data limits. The gaps were then filled using a Fourier domain data wrapping approach. To supplement the laser data, SRTM data were excised to an area 15 km beyond the survey area. The excised data were filled using the same Fourier domain wrapping method, then adjusted to the level of the laser scanner data prior to merging.

Figure 6 show the final Digital Terrain Model for each area resulting from the laser scanner and SRTM data processing.

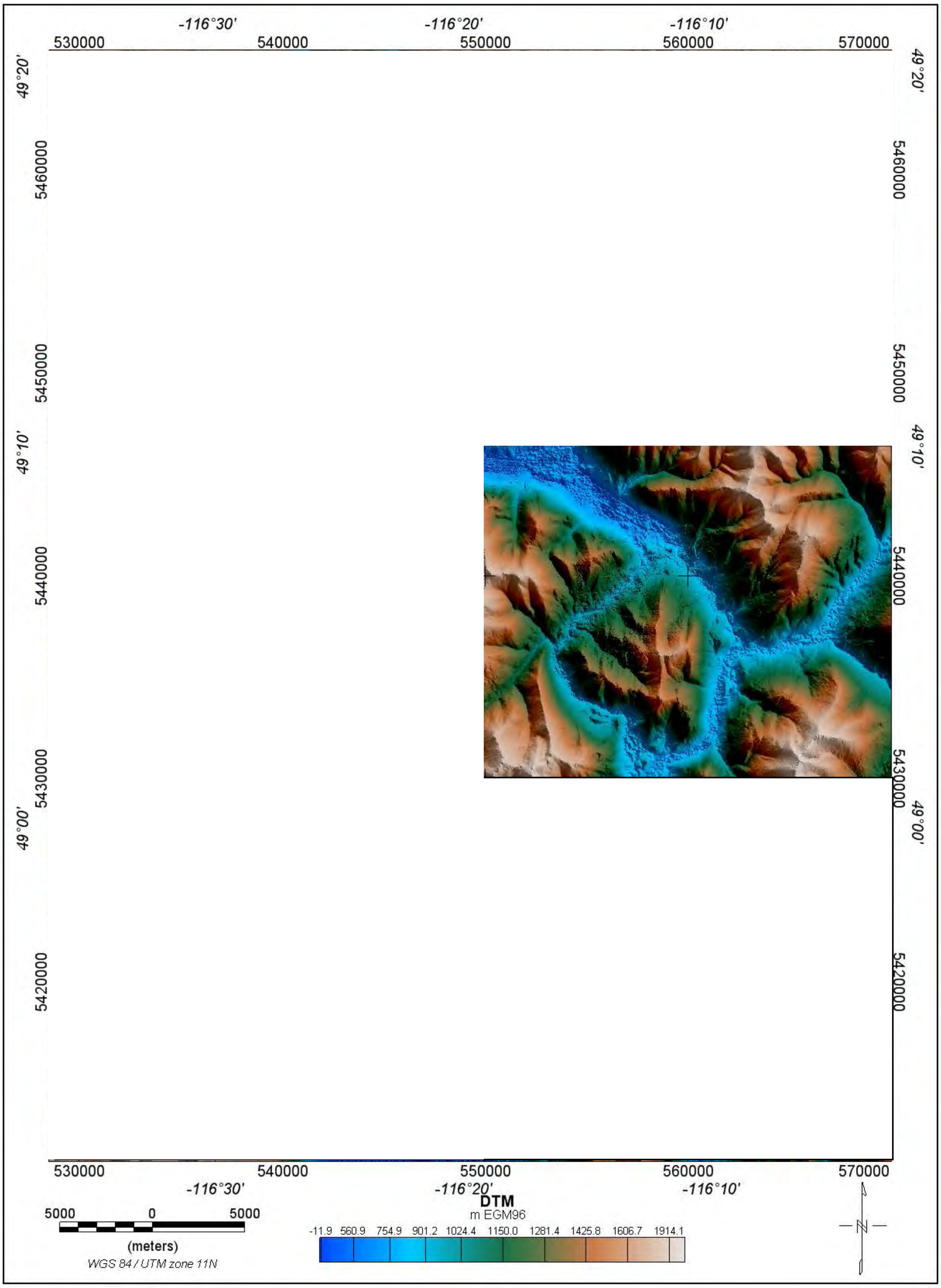

Figure 6: Goatfell – *Final Digital Terrain Model (metres, referenced to the EGM96 geoid)*

4.6 Terrain Clearance

Terrain clearance for the survey averaged well above the nominal clearance of 30 m having a mean value of 107.3 m across the survey areas. The terrain clearances, as derived from laser scanner data, are shown in *Figure 7*.

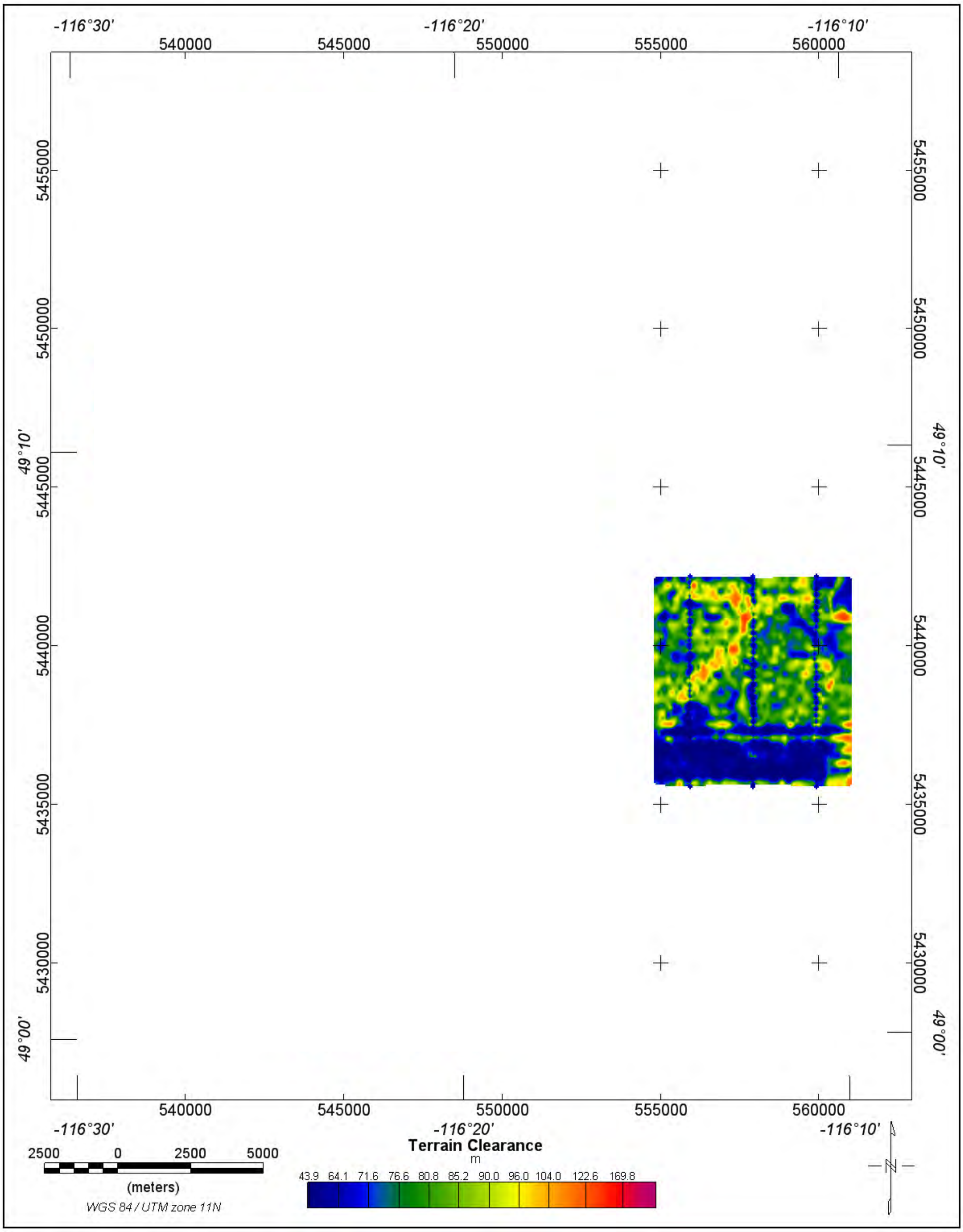

Figure 7: Goatfell – *Terrain Clearance from laser scanner data (metres above ground surface)*

5 HeliFALCON™ AIRBORNE GRAVITY GRADIENT (AGG) RESULTS

5.1 Processing Summary

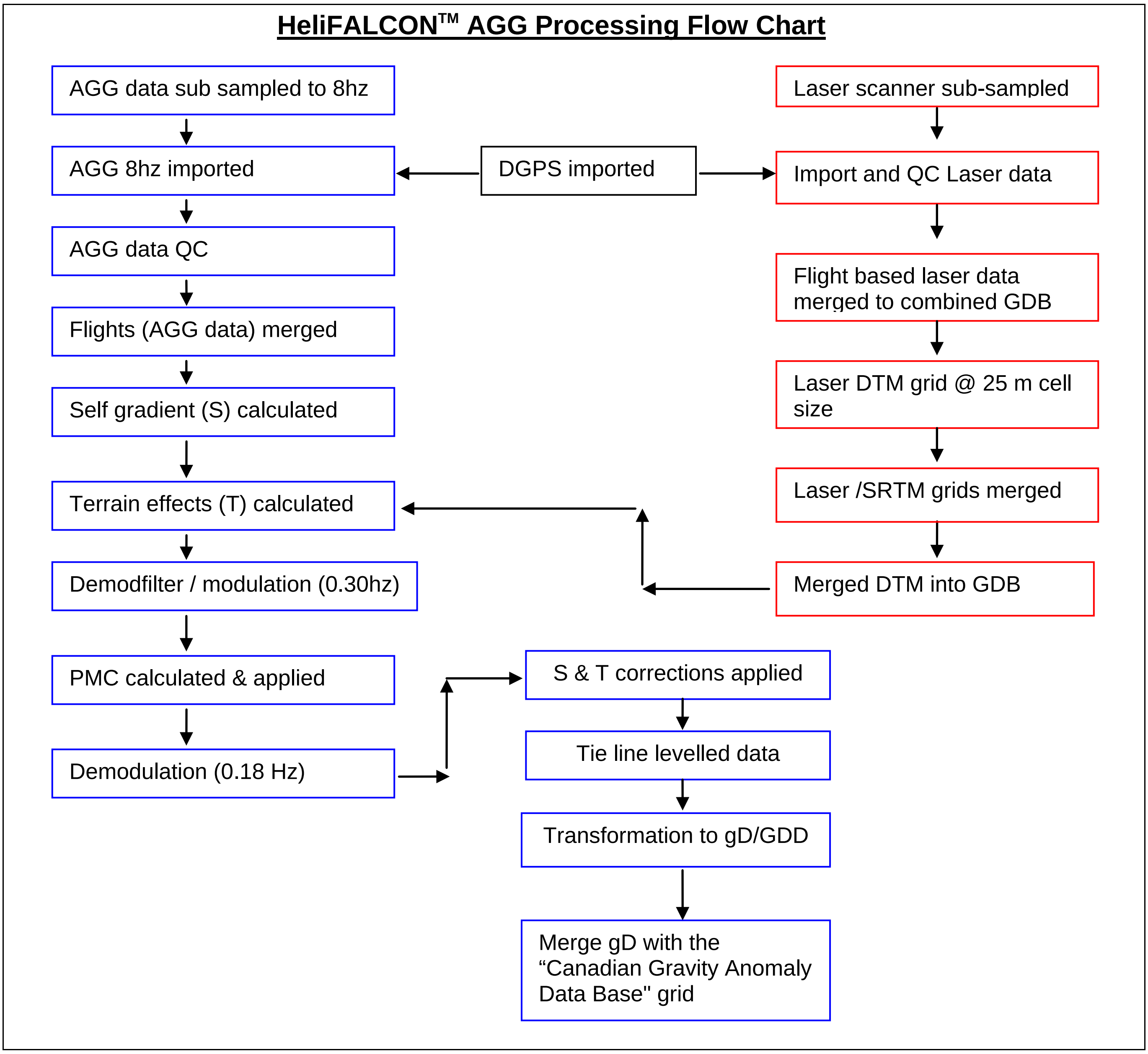

Figure 8: *FALCON™ AGG Data Processing*

5.2 HeliFALCON™ Airborne Gravity Gradiometer Data

Figure 8 summarises the steps involved in processing the AGG data obtained from the survey.

The **HeliFALCON™** Airborne Gravity Gradiometer data were digitally recorded by the ADAS on removable hard drives. The raw data were then copied on to the field processing laptop, backed up twice onto DVD+R media and shipped to Fugro Perth using a secure courier service.

Preliminary processing and QC of the **HeliFALCON™** AGG data were completed on-site using Fugro's DiAGG software.

Further QC and Final **HeliFALCON™** AGG data processing were performed by the office based data processor.

5.3 Radar Altimeter Data

The terrain clearance measured by the radar altimeter in metres was recorded at 10 Hz. The data were plotted and inspected for quality.

5.4 Laser Scanner Data

The terrain clearance measured by the laser scanner in metres was recorded at 20 scans/sec with 276 data points per scan, and was then sub-sampled using a window width of 0.25 sec. The sub-sampled laser scanner data were edited to remove spikes prior to gridding.

5.5 Positional Data

A number of programs were executed for the compilation of navigation data in order to reformat and recalculate positions in differential mode. Waypoint's GrafNav GPS processing software was used to calculate DGPS positions from raw range data obtained from the moving (airborne) and stationary (ground) receivers.

The GPS ground station position was determined by logging GPS data continuously for 24 hours prior to survey flights commencing. The GPS data were processed and quality controlled completely in the field.

Positional data (longitude, latitude, Z) were output in the WGS84 datum. The longitude and latitude data were then projected into UTM Zone 11N coordinates.

Parameters for the WGS84 datum are:

Ellipsoid:	WGS84
Semi-major axis:	6378137.0 m
1/flattening:	298.257

All processing was performed using WGS84/UTM Zone 11N coordinates. Final line data and final grid data were supplied in this projection.

5.6 Additional Processing

For the terrain correction, in the absence of any knowledge of the local geology, the standard density of 2.67 g/cm^3 was selected. Typically 2.67 g/cm^3 will work well for most terrain types but may lead to over correction or under correction in some areas. The data were tie line levelled.

5.7 HeliALCON™ Airborne Gravity Gradient Data - G_{DD} & g_D

The transformation into G_{DD} and g_D was accomplished using two methods: Fourier domain transformation and the Method of Equivalent Sources

5.7.1 Fourier

The Fourier domain transformation method uses a low-pass filter to improve the signal to noise ratio by removing processing artefacts and other information which is known to be beyond the sampling resolution. A cut-off wavelength of 700 m was used in the low-pass filter.

5.7.2 Equivalent Source

The equivalent source transformation utilises a smooth model inversion to calculate the density of a surface of sources followed by a forward calculation to produce g_D and G_{DD}. It was possible to closely match the wavelength characteristics of the Fourier results by placing the sources at a depth of 700 metres.

5.7.3 Drape Surfaces

Both transformations use a smoothed surface onto which the output data are projected. These surfaces are smoother equivalents of the actual flying surface.

The Fourier and equivalent source (density 2.67 g/cm^3) G_{DD} maps are shown in *Figure 9 and 10*.

Two versions of vertical gravity (g_D) are presented: Fourier, derived by integrating G_{DD}; and equivalent source, derived directly from the modelled sources. The (density 2.67 g/cm^3) Fourier results are presented in *Figure 11* and the (density 2.67 g/cm^3) equivalent source results are presented in *Figure 12*.

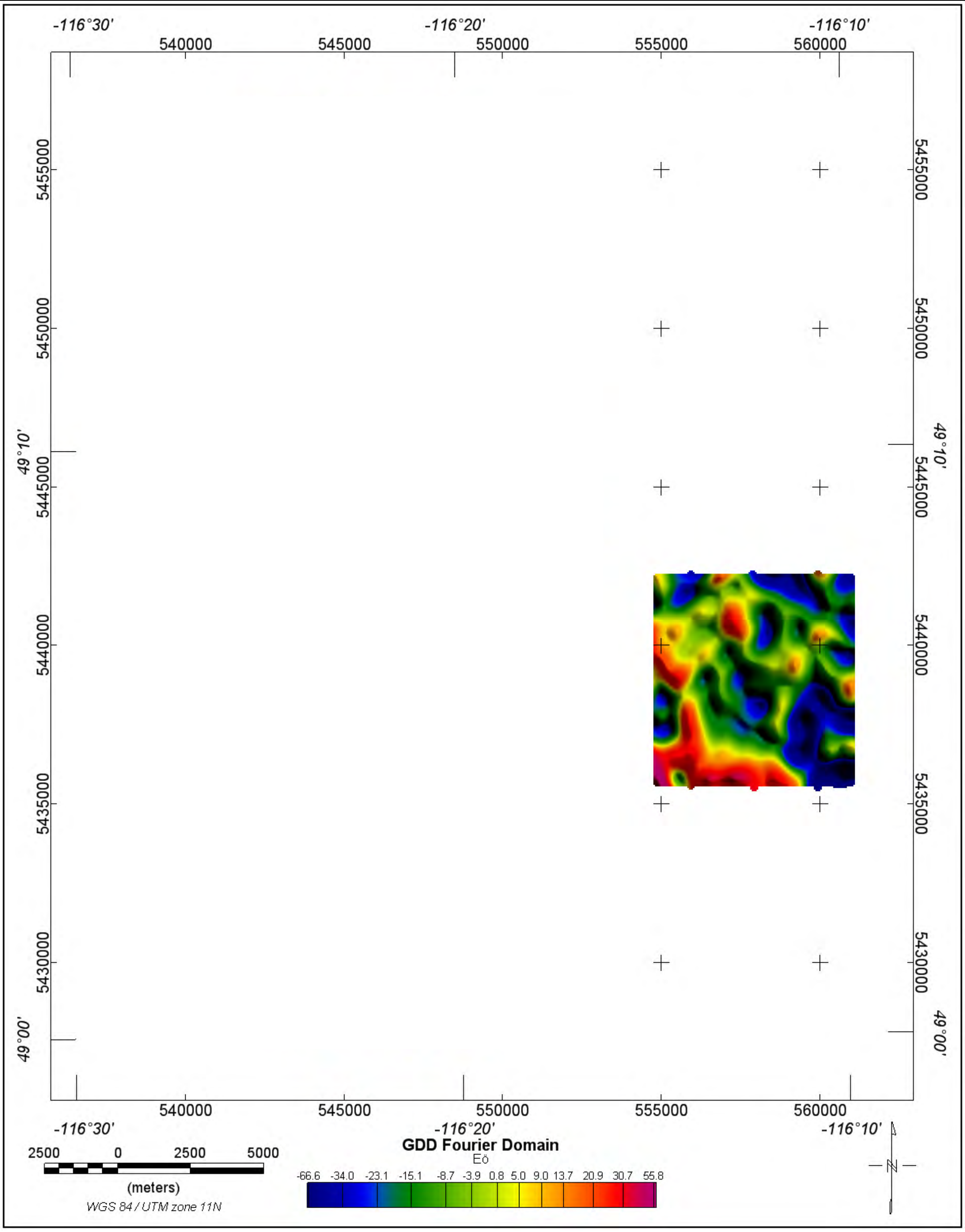

Figure 9: Goatfell – *Vertical Gravity Gradient (G_{DD}) from Fourier processing (E).*

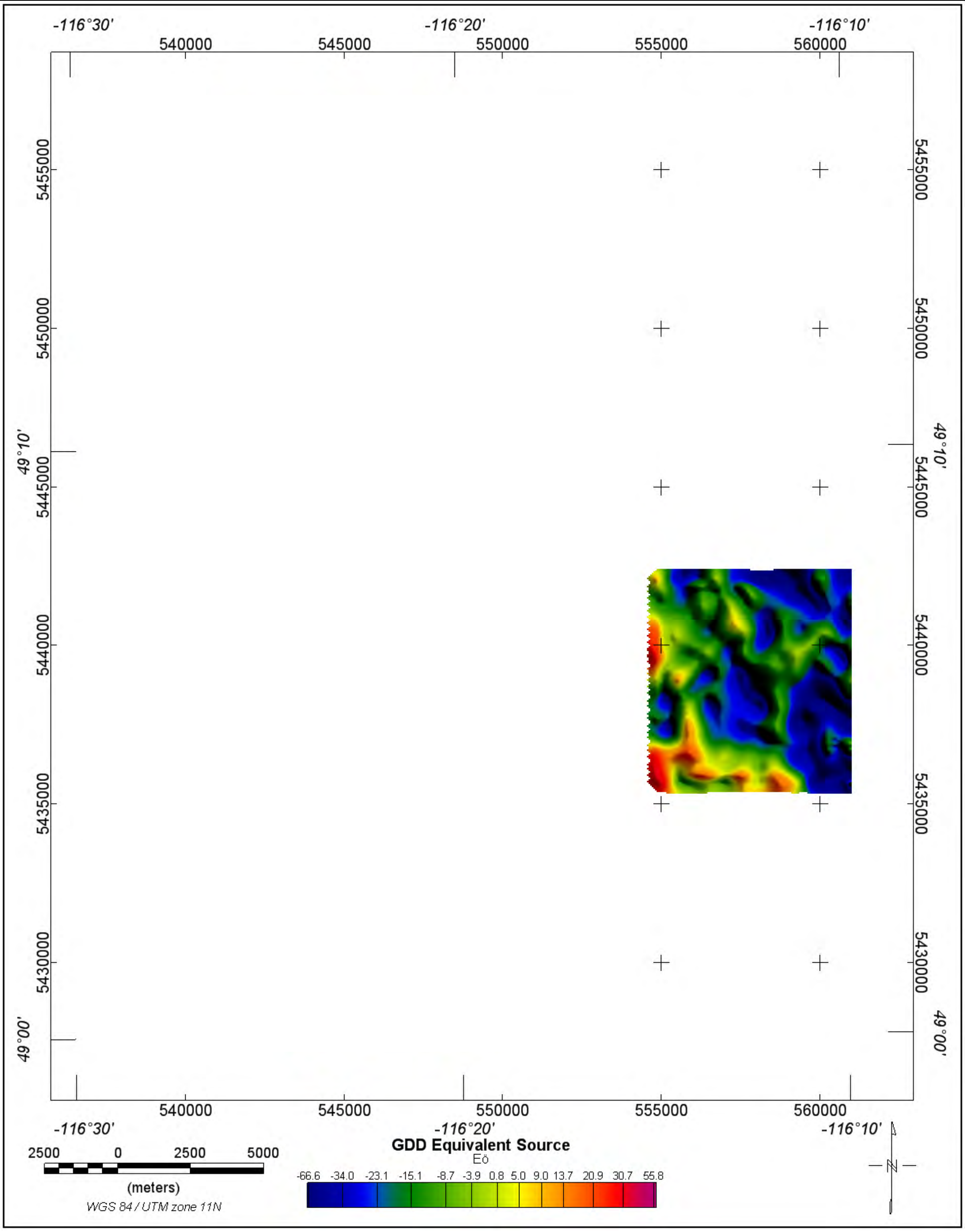

Figure 10: Goatfell – *Vertical Gravity Gradient (G_{DD}) from equivalent source processing (E).*

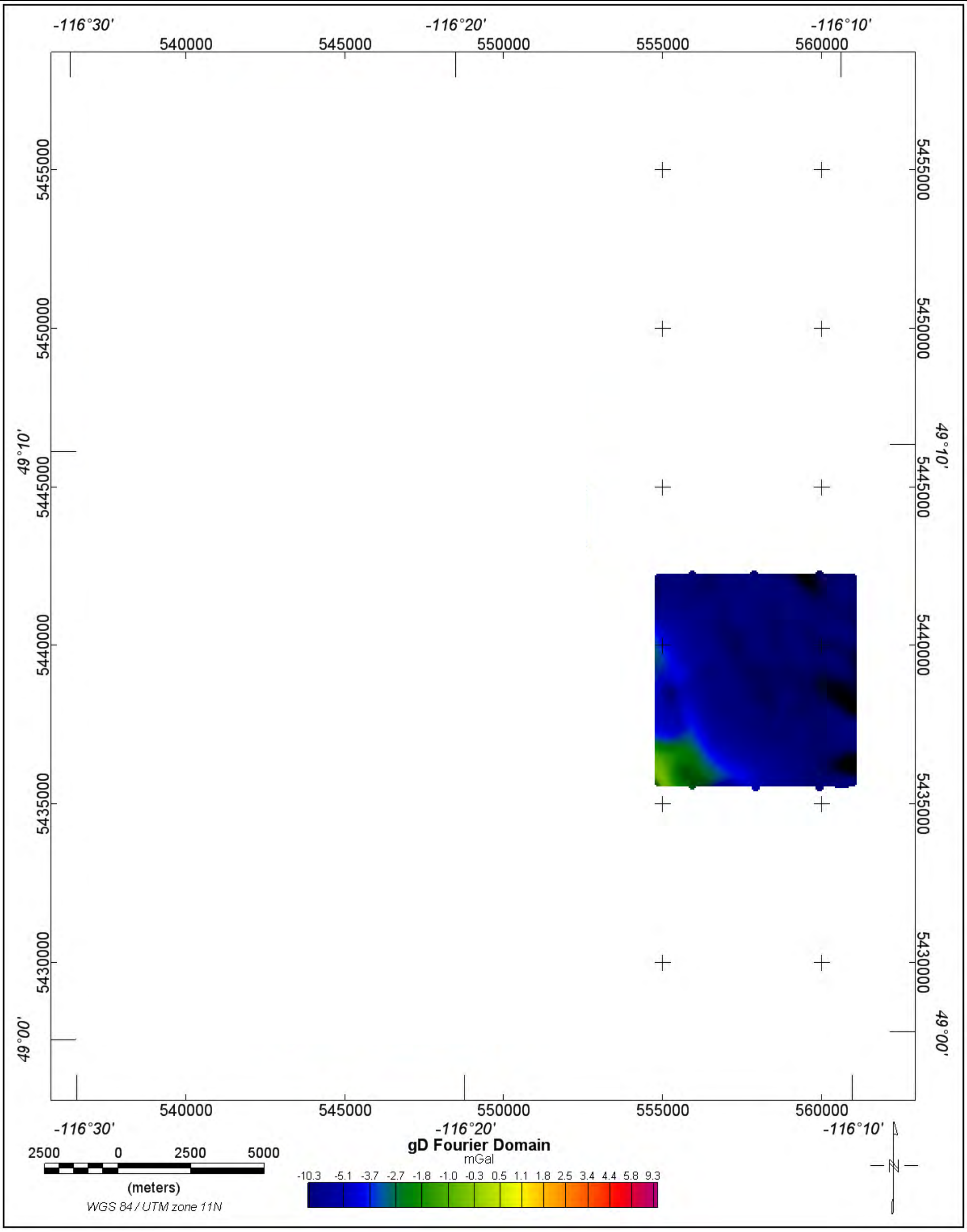

Figure 11: Goatfell – *Vertical Gravity (g_D) from Fourier processing (mGal)*

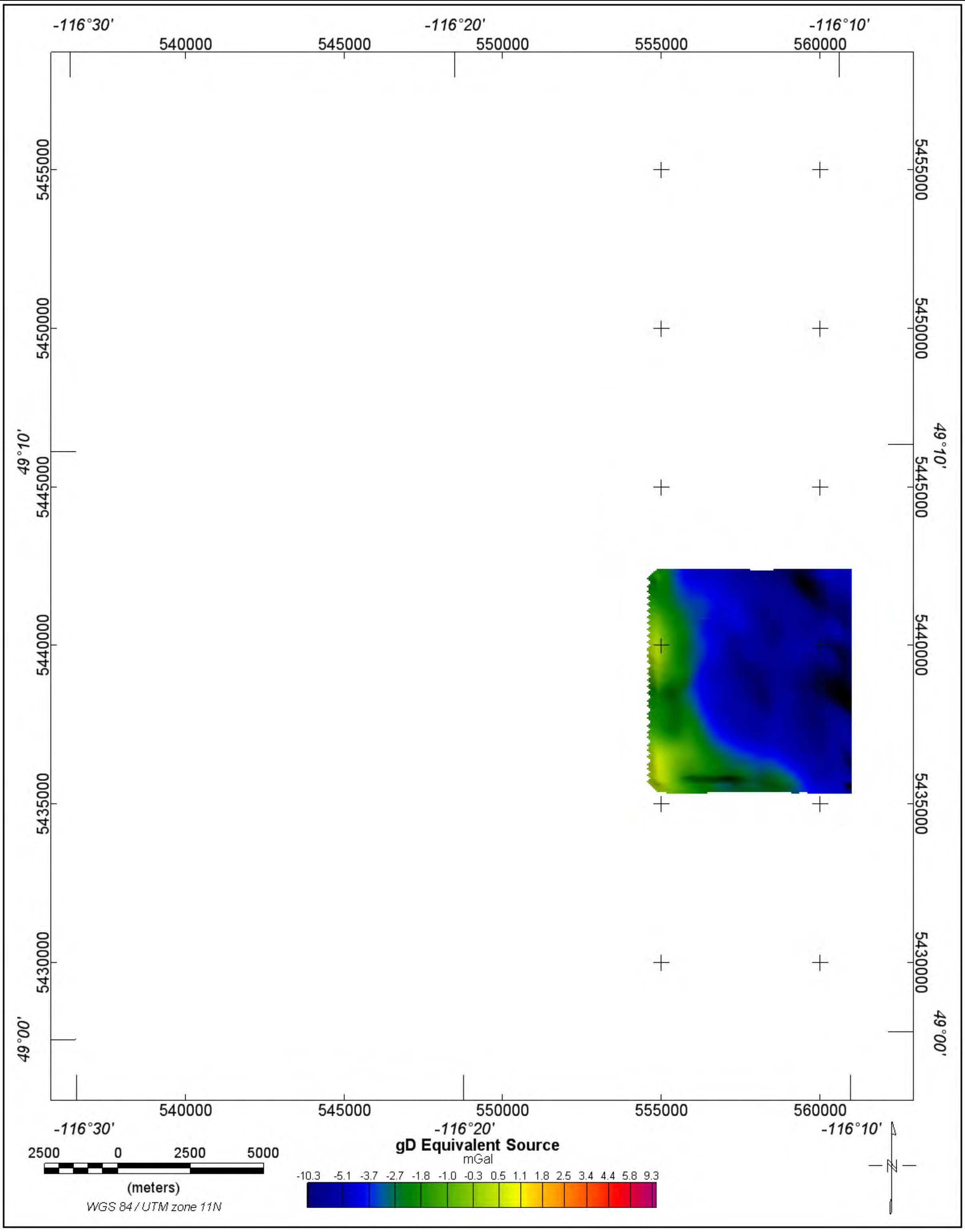

Figure 22: Goatfell – *Vertical Gravity (g_D) from equivalent source processing (mGal)*

5.8 Conforming g_D to regional gravity

As discussed in section 8.3, the long wavelength information in g_D (both the Fourier and equivalent source versions) can be improved by incorporating ancillary information. Such information is available in the form of the Canadian Gravity Anomaly Data Base.

The Fourier and equivalent source g_D grids were conformed to a grid derived from a subset of the Canadian Gravity Anomaly Data Base as follows. The (density 2.67 g/cm^3) results are presented in *Figure 13 and Figure 14.*

- Low pass filter the regional data using a cosine squared filter with cut-off at 30km, tapering to 20km.
- High pass filter the g_D data (Fourier and equivalent source) using a cosine squared filter with cut-off at 30 km, tapering to 20km.
- Conform the Fourier and equivalent source data to the regional data by addition of the filtered grids. The filter design is such that this method provides uniform frequency response across the overlap frequencies.

Further discussion of this method can be found in Dransfield (2010).

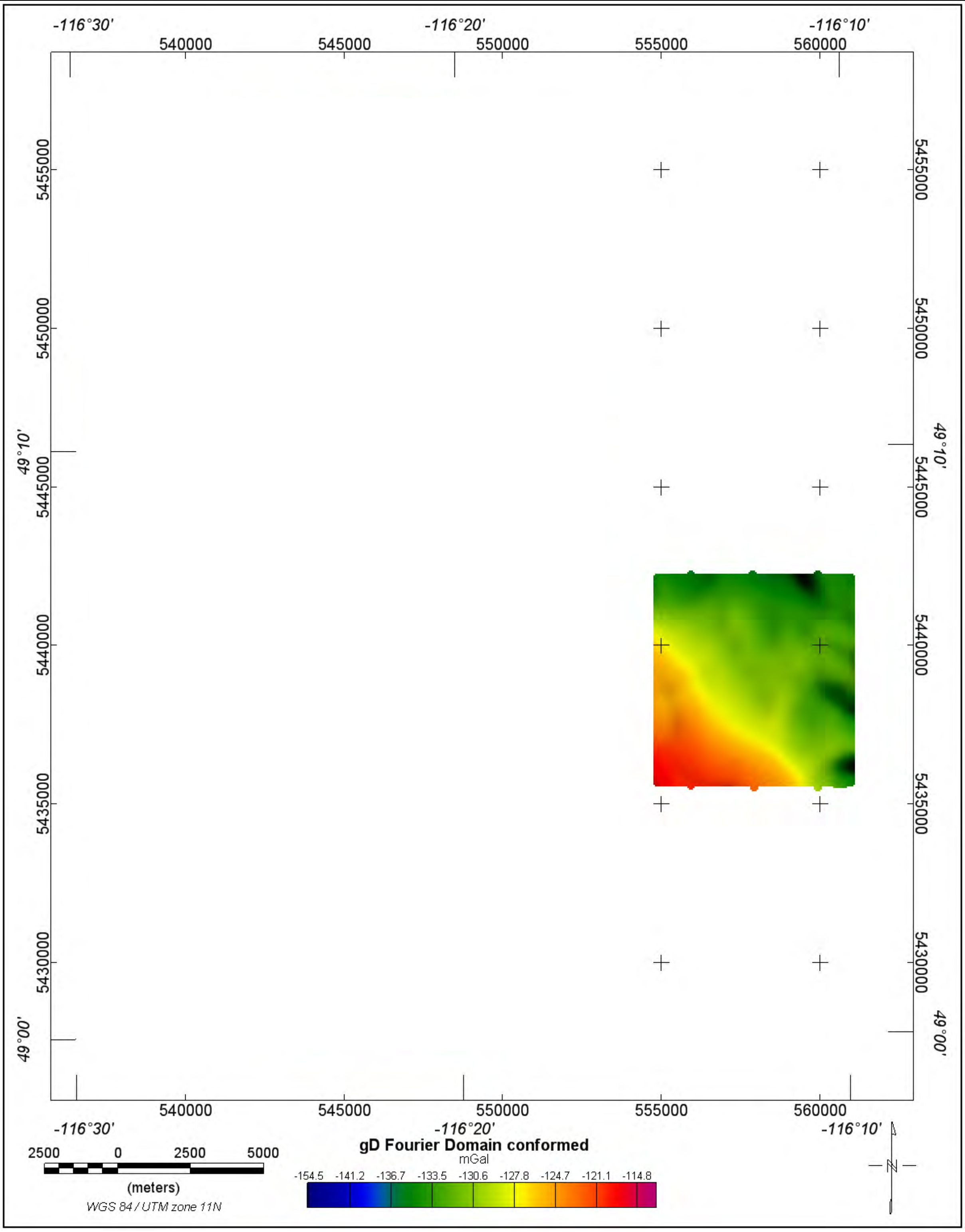

Figure 13: Goatfell – *Vertical Gravity (g_D) from Fourier processing conformed to regional gravity data (mGal)*

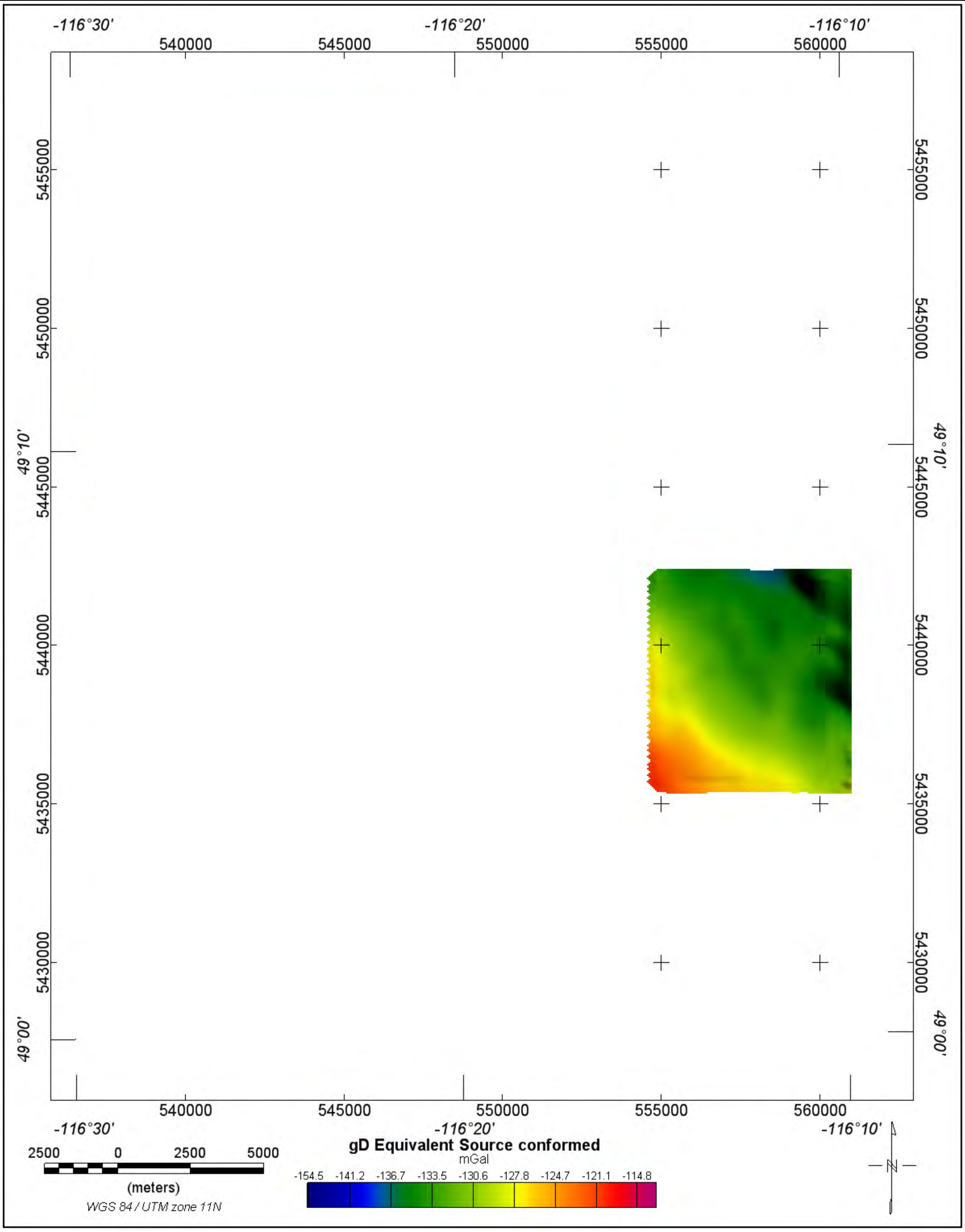

Figure 14: Goatfell – *Vertical Gravity (g_D) from equivalent source processing conformed to regional gravity data (mGal).*

6 APPENDIX I - SURVEY EQUIPMENT

6.1 Survey Aircraft

A Great Slave Helicopters owned Eurocopter AS350-B3 with Canadian registration C-GYAV, was used to fly the survey area. The following instrumentation was used for this survey.

6.2 HeliFALCON™ Airborne Gravity Gradiometer

HeliFALCON™ *AGG System*
The **HeliFALCON**™ AGG System is based on current state-of-the-art airborne gravity gradiometer technology and has been optimized for airborne broad band geophysical exploration. The system is capable of supporting surveying activities in areas ranging from 1,000 ft below sea level to 13,000 ft above sea level with aircraft speeds from 70 to 130 knots. The **HeliFALCON**™ AGG data streams were digitally recorded at different rates on removable drives installed in the **HeliFALCON**™ AGG electronics rack.

6.3 Airborne Data Acquisition Systems

Fugro Digital Acquisition System (FASDAS)
The Fugro FASDAS is a data acquisition system executing propriety software for the acquisition and recording of location, magnetic and ancillary data. Data are presented both numerically and graphically in real time on the VGA display providing on-line quality control capability.

The FASDAS is also used for real time navigation. A pre-programmed flight plan containing boundary coordinates, line start and end coordinates, the altitude values calculated for a theoretical drape surface, line spacing and cross track definitions is loaded into the computer prior to each flight. The WGS-84 latitude and longitude and altitude received from the real-time corrected, dual frequency Novatel OEMV L1/l2-Band Positioning receiver, is transformed to the local coordinate system for cross track and distance to go values. This information, together with ground heading and speed, is displayed to the pilot numerically and graphically on a two line LCD display. It is also presented on the operator LCD screen in conjunction with a pictorial representation of the survey area, survey lines and ongoing flight path.

HeliFALCON™ *AGG Data Acquisition System (ADAS)*
The FASDAS provides control and data display for the **HeliFALCON**™ AGG system. Data is displayed real time for the operator and warnings displayed should system parameters deviate from tolerance specifications. All **HeliFALCON**™ AGG and laser scanner data are recorded to a removable hard drive.

6.4 Real-Time Differential GPS

Novatel OEMV L-Band Positioning
The Novatel OEMV L-band Positioning receiver provides real-time differential GPS for the onboard navigation system. The differential data set was relayed via a geo-synchronous satellite to the aircraft where the receiver optimized the corrections for the current location.

6.5 GPS Base Station Receiver

Novatel OEM4 L1/L2
The Novatel GPS receiver is a 12 channel dual frequency GPS receiver. It provides raw range information of all satellites in view sampled every second and recorded on a computer laptop. These data are post-processed with the rover data to provide differential GPS (DGPS) corrections for the flight path.

6.6 Altimeters

Honeywell RT300 / AT220

6.7 Laser Scanner

Riegl LMS-Q140I-80

The laser scanner is designed for high speed line scanning applications. The system is based upon the principle of time-of-flight measurement of short laser pulses in the infrared wavelength region and the angular deflection of the laser beam is obtained by a rotating polygon mirror wheel. The measurement range is up to 400 m with a minimum range of 2 m and an accuracy of 50mm. The laser beam is eye safe, the laser wavelength is 0.9 μm, the scan angle range is +/- 40° □and the scan speed is 20 scans/

6.8 Data Processing Hardware and Software

The following equipment and software were used:

Hardware

- One 2.0 GHz (or higher) laptop computer
- External USB hard drive reader for ADAS removable drives
- Two External USB hard drives for data backup
- HP DeskJet All-In-One printer, copier, scanner

Software

- Oasis Montaj data processing and imaging software
- GrafNav Differential GPS processing software
- Fugro - Atlas data processing software
- Fugro - DiAGG processing software

7 APPENDIX II - SYSTEM TESTS

7.1 Instrumentation Lag

Due to the relative position of the magnetometer, altimeters and GPS antenna on the aircraft and to processing/recording time lags, raw readings from each data stream vary in position. To correct for this and to align selected anomaly features on lines flown in opposite directions, the magnetic and altimeter data are ‘parallaxed’ with respect to the position information. The lags were applied to the data during processing.

7.2 Radar Altimeter Calibration

The radar altimeter is checked for accuracy and linearity every 12 months, or when any change in a key system component requires this procedure to be carried out. This calibration allows the radar altimeter data to be compared and assessed with the other height data (GPS, barometric and laser) to confirm the accuracy of the radar altimeter over its operating range. The calibration is performed by flying a number of 30 second lines at preselected terrain clearances over an area of flat terrain and using the results of the radar altimeter, differentially corrected GPS heights in mean sea level (MSL) and laser scanner were used to derive slope and offset information.

7.3 HeliFALCON™ AGG Noise Measurement

At the commencement of the survey, 20 minutes of data were collected with the aircraft in straight level flight at 3500 ft AGL. These data were processed as a survey line to check the AGG noise levels.

Daily flight debriefs incorporating HeliFALCON™ AGG performance statistics for each flight line are prepared using output from Fugro DiAGG software. These are sent daily to Fugro office staff for performance evaluation.

7.4 Daily Calibrations

A set of daily calibrations were performed each survey day as follows:
- AGG Quiescent Calibration
- Low level test line

7.4.1 HeliFALCON™ AGG Calibration

A calibration was performed at the beginning of each flight and the results monitored by the operator. The coefficients obtained from each of the calibrations were used in the processing of the data.

8 APPENDIX III - HeliFALCON™ AGG DATA & PROCESSING

8.1 Nomenclature

The **HeliFALCON™** airborne gravity gradiometer (AGG) system adopts a North, East, and Down coordinate sign convention and these directions (N, E, and D) are used as subscripts to identify the gravity gradient tensor components (gravity vector derivatives). Lower case is used to identify the components of the gravity field and upper case to identify the gravity gradient tensor components. Thus the parameter usually measured in a normal exploration ground gravity survey is $\mathbf{g_D}$ and the vertical gradient of this component is $\mathbf{G_{DD}}$.

8.2 Units

The vertical component of gravity ($\mathbf{g_D}$) is delivered in the usual units of mGal. The gradient tensor components are delivered in eotvos, which is usually abbreviated to "E". By definition **1 E = 10^{-4} mGal/m.**

8.3 HeliFALCON™ Airborne Gravity Gradiometer Surveys

In standard ground gravity surveys, the component measured is "$\mathbf{g_D}$", which is the *vertical component of the acceleration due to gravity*. In airborne gravity systems, since the aircraft is itself accelerating, measurement of "$\mathbf{g_D}$" cannot be made to the same precision and accuracy as on the ground. Airborne gravity gradiometry uses a differential measurement to remove the aircraft motion effects and delivers gravity data of a spatial resolution and sensitivity comparable with ground gravity data.

The **HeliFALCON™** gradiometer instrument acquires two curvature components of the gravity gradient tensor namely $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ where $\mathbf{G_{UV}} = (\mathbf{G_{EE}} - \mathbf{G_{NN}})/2$. Since these curvature components cannot easily and intuitively be related to the causative geology, they are transformed into the vertical gravity gradient ($\mathbf{G_{DD}}$), and integrated to derive the vertical component of gravity ($\mathbf{g_D}$). Interpreters display, interpret and model both $\mathbf{G_{DD}}$ and $\mathbf{g_D}$. The directly measured $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ data are appropriate for use in inversion software to generate density models of the earth. The vertical gravity gradient, $\mathbf{G_{DD}}$, is more sensitive to small or shallow sources and has greater spatial resolution than $\mathbf{g_D}$ (similar to the way that the vertical magnetic gradient provides greater spatial resolution and increased sensitivity to shallow sources of the magnetic field). In the integration of $\mathbf{G_{DD}}$ to give $\mathbf{g_D}$, the very long wavelength component, at wavelengths comparable to or greater than the size of the survey area, cannot be fully recovered. Long wavelength gravity are therefore incorporated in the $\mathbf{g_D}$ data from other sources. This might be regional ground, airborne or marine gravity if such data are available. The Danish National Space Centre global gravity data of 2008 (DNSC08) are used as a default if other data are not available.

8.4 Gravity Data Processing

The main elements and sequence of processing of the gravity data are as follows:

1. Dynamic corrections for residual aircraft motion (called Post Mission Compensation or PMC) are calculated and applied.
2. Self gradient corrections are calculated and applied to reduce the time-varying gradient response from the aircraft and platform.
3. A Digital Terrain Model (DTM) is created from the laser scanner range data, the AGG inertial navigation system rotation data and the DGPS position data.
4. Terrain corrections are calculated and applied.

5. $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ are levelled and transformed into the full gravity gradient tensor, including $\mathbf{G_{DD}}$, and into $\mathbf{g_D}$.

8.5 Aircraft dynamic corrections

The design and operation of the **HeliFALCON[TM]** AGG results in very considerable reduction of the effects of aircraft acceleration but residual levels are still significant and further reduction is required and must be done in post-processing.

Post-processing correction relies on monitoring the inertial acceleration environment of the gravity gradiometer instrument (GGI) and constructing a model of the response of the GGI to this environment. Parameters of the model are adjusted by regression to match the sensitivity of the GGI during data acquisition. The modelled GGI output in response to the inertial sensitivities is subtracted from the observed output. Application of this technique to the output of the GGI, when it is adequately compensated by its internal mechanisms, reduces the effect of aircraft motion to acceptable levels.

Following these corrections, the gradient data are demodulated and filtered along line with a 6-pole Butterworth low-pass filter with a cut-off frequency of 0.18 Hz (for fixed-wing operations; a higher frequency may be used for helicopter operations).

8.6 Self gradient Corrections

The GGI is mounted in gimbals controlled by an inertial navigation system which keeps the GGI pointing in a fixed direction whilst the aircraft and gimbals rotate around it. Consequently, the GGI measures a time-varying gravity gradient due to these masses moving around it as the heading and attitude of the aircraft changes during flight. This is called the self-gradient.

Like the aircraft dynamic corrections, the self-gradient is calculated by regression of model parameters against measured data. In this case, the rotations of the gimbals are the input variables of the model. Once calculated, the modelled output is subtracted from the observed output.

8.7 Laser Scanner Processing

The laser scanner measures the range from the aircraft to the ground in a swathe of angular width ±40 degrees below the aircraft. The aircraft attitude (roll, pitch and heading) data provided by the AGG inertial navigation system are used to adjust the range data for changes in attitude and the processed differential GPS data are used to reference the range data to located ground elevations referenced to the WGS 84 datum. Statistical filtering strategies are used to remove anomalous elevations due to foliage or built up environment. The resulting elevations are gridded to form a digital terrain model (DTM).

8.8 Terrain Corrections

An observation point above a hill has excess mass beneath it compared to an observation point above a valley. Since gravity is directly proportional to the product of the masses, uncorrected gravity data have a high correlation with topography.

It is therefore necessary to apply a terrain correction to gravity survey data. For airborne gravity gradiometry at low survey heights, a detailed DTM is required. Typically, immediately below the aircraft, the digital terrain will need to be sampled at a cell size roughly one-third to one-half of the survey height and with a position accuracy of better than 1 metre. For these accuracies, LIDAR data are required and each **HeliALCON™** survey aircraft comes equipped with LIDAR (laser scanner).

If bathymetric data are used then these form a separate terrain model for which terrain corrections are calculated at a density chosen to suit the water bottom – water interface. Once the DTM has been merged, the terrain corrections for each of the $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ data streams are calculated. In the calculation of terrain corrections, a density of 1 gm/cc is used. The calculated corrections are stored in the database allowing the use of any desired terrain correction density by subtracting the product of desired density and correction from the measured $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ data. The terrain correction density is chosen to be representative of the terrain density over the survey area. Sometimes more than one density is used with input from the client.

Typically, the terrain corrections are calculated over a distance 10 km from each survey measurement point.

8.9 Tie-line Levelling

The terrain- and Self gradient-corrected $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ data are tie-line levelled across the entire survey using a least-squares minimisation of differences at survey line intersections. Occasionally some micro-levelling might be performed.

8.10 Transformation into $\mathbf{G_{DD}}$ & $\mathbf{g_D}$

The transformation of the measured, corrected and levelled $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ data into gravity and components of the full gravity gradient tensor is accomplished using two methods:

- Fourier domain transformation and
- Equivalent source transformation.

The Fourier method relies on the Fourier transform of Laplace's equation. The application of this transform to the complex function $\mathbf{G_{NE} + i\, G_{UV}}$ provides a stable and accurate calculation of each of the full tensor components and gravity. The Fourier method performs piece-wise upward and downward continuation to work with data collected on a surface that varies from a flat horizontal plane. For stability of the downward continuation, the data are low-pass filtered. The cut-off wavelength of this filter depends on the variations in altitude and the line spacing. It is set to the smallest value that provides stable downward continuation.

The equivalent source method relies on a smooth model inversion to calculate the density of a surface of sources and from these sources, a forward calculation provides the $\mathbf{G_{DD}}$ and $\mathbf{g_D}$ data. The smoothing results in an output that is equivalent to the result of the low-pass filter in the Fourier domain method.

The Fourier method generates all tensor components but the equivalent source method only generates $\mathbf{G_{DD}}$ and $\mathbf{g_D}$ (and $\mathbf{G_{NE}}$ and $\mathbf{G_{UV}}$ for comparison with the inputs).

The limitations of gravity gradiometry in reconstructing the long wavelengths of gravity can lead to differences in the results of these two methods at long wavelength. The merging of the $\mathbf{g_D}$ data with externally supplied regional gravity such as the DNSC08 gravity removes these differences.

8.11 Noise & Signal

With all the **HeliFALCON™** AGG instruments, there are two measurements made of both the NE and UV curvature components during acquisition. This gives a pair of independent readings at each sample point.

The standard deviation of half the difference between these pairs is a good estimate of the survey noise. This is calculated for each line, and the average of all the survey lines is the figure quoted for the survey as a whole.

This difference error has been demonstrated to follow a 'normal' or Gaussian statistical distribution, with a mean of zero. Therefore, the bulk of the population (95%) will lie between -2σ and +2σ of the mean. For a typical survey noise estimate of, say, 3 E, 95% of the noise will be between -6 E and +6 E.

These typical errors in the curvature gradients translate to errors in $\mathbf{G_{DD}}$ of about 5 E and in $\mathbf{g_D}$ (in the shorter wavelengths) in the order of 0.1 mGal.

8.12 Risk Criteria in Interpretation

The risks associated with a **HeliFALCON™** AGG survey are mainly controlled by the following factors.

- **Survey edge anomalies** – the transformation from measured curvature gradients to vertical gradient and vertical gravity gradient is subject to edge effects. Hence any anomalies located within about 2 x line spacing of the edge of the survey boundaries should be treated with caution.
- **Single line anomalies** – for a wide-spaced survey, an anomaly may be present on only one line. Although it might be a genuine anomaly, the interpreter should note that no two-dimensional control can be applied.
- **Low amplitude (less than 2σ) anomalies** – Are within the noise envelope and need to be treated with caution, if they are single line anomalies and close in diameter to the cut-off wavelengths used.
- **Residual topographic error anomalies** – Inaccurate topographic correction either due to inaccurate DTM or local terrain density variations may produce anomalies. Comparing the DTM with the G_{DD} map terrain-corrected for different densities is a reliable way to confirm the legitimacy of an anomaly.
- **The low density of water and lake sediments** – (if present) can create significant gravity and gravity gradient lows which may be unrelated to bedrock geology. It is recommended that all anomalies located within lakes or under water be treated with caution and assessed with bathymetry if available.

8.13 References

Boggs, D. B. and Dransfield, M. H., 2004, Analysis of errors in gravity derived from the Falcon airborne gravity gradiometer, Lane, R. (ed.), Airborne Gravity 2004 - Abstracts from the ASEG-PESA Airborne Gravity 2004 Workshop, Geoscience Australia Record 2004/18, 135-141.

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Stone, P. M. and Simsky, A., 2001, Constructing high resolution DEMs from Airborne Laser Scanner Data, Preview, Extended Abstracts: ASEG 15th Geophysical Conference and Exhibition, August 2001, Brisbane, 93, 99.

9 APPENDIX IV - FINAL PRODUCTS

Final **HeliFALCON™** AGG digital line data were provided in 8 Hz ASCII and Geosoft Oasis GDB database files containing the fields and format described in *Table 4* below.

Final aeromagnetic digital line data were provided in 10Hz ASCII and Geosoft Oasis GDB database files containing the fields and format described in *Table 5* below.

Grids of Fourier and equivalent source products, Total Magnetic Intensity, First Vertical Derivative of the Total Magnetic Intensity, as well as the DTM were delivered, as described in *Table 6* below. The grids are in ERMapper ERS format with a 50 m cell size (35 m for Vulcan), with the exception of the DTM grids which have a 10 m cell size.

One copy of the digital archives was delivered along with a hard copy of this Logistics and Processing Report.

Field	Variable	Description	Units
1	line	Line Number	-
2	time_1980	Universal Time (Seconds Since January 6, 1980)	sec.
3	flight	Flight Number	-
4	date	Date of Survey Flight	yyyymmd
5	lat_wgs84	Latitude in WGS84	degrees
6	long_wgs84	Longitude in WGS84	degrees
7	x_wgs84	Easting (X) in WGS84 UTM Zone 11N	metres
8	y_wgs84	Northing (Y) in WGS84 UTM Zone 11N	metres
9	gpsz	GPS Elevation (Referenced to WGS84 Datum)	metres
11	height	Calculated Laser Scanner Clearance (gpsz - dtm)	metres
12	dtm	Terrain (Referenced to WGS84 Datum)	metres
13	turbulence	Estimated vertical platform turbulence (vertical acceleration where g = 9.80665 m/sec/sec)	millig
14	Err_NE	NE gradient uncorrelated noise estimate, after tie-line levelling	eotvos
15	Err_UV	UV gradient uncorrelated noise estimate, after tie-line levelling	eotvos
16	T_DD	Terrain effect calculated for DD using a density of 1g/cm^3	eotvos
17	T_NE	Terrain effect calculated for NE using a density of 1g/cm^3	eotvos
18	T_UV	Terrain effect calculated for UV using a density of 1g/cm^3	eotvos
19	A_0_NE	Self gradient, jitter & terrain corrected NE gradient, no terrain correction applied	eotvos
20	A_0_UV	Self gradient, jitter & terrain corrected UV gradient, no terrain correction applied	eotvos
21	B_0_NE	Self gradient, jitter & terrain corrected NE gradient, no terrain correction applied	eotvos
22	B_0_UV	Self gradient, jitter & terrain corrected UV gradient, no terrain correction applied	eotvos
23	A_2p67_NE	Self gradient, jitter & terrain corrected NE gradient, terrain correction density 2.67 g/cm^3	eotvos
24	A_2p67_UV	Self gradient, jitter & terrain corrected UV gradient, terrain correction density 2.67 g/cm^3	eotvos
25	B_2p67_NE	Self gradient, jitter & terrain corrected NE gradient, terrain correction density 2.67 g/cm^3	eotvos
26	B_2p67_UV	Self gradient, jitter & terrain corrected UV gradient, terrain correction density 2.67 g/cm^3	eotvos
27	gD_Fourier_2p67	Fourier derived vertical gravity, terrain correction density 2.67 g/cm^3	mGal
28	GEE_Fourier_2p67	Fourier derived Gee gradient, terrain correction density 2.67 g/cm^3	eotvos

29	GNN_Fourier_2p67	Fourier derived Gnn gradient, terrain correction density 2.67 g/cm^3	eotvos
30	GDD_Fourier_2p67	Fourier derived vertical gravity gradient, terrain correction density 2.67 g/cm^3	eotvos
31	GED_Fourier_2p67	Fourier derived Ged horizontal EW gradient, terrain correction density 2.67 g/cm^3	eotvos
32	GND_Fourier_2p67	Fourier derived Gnd horizontal NS gradient, terrain correction density 2.67 g/cm^3	eotvos
33	GNE_Fourier_2p67	Fourier derived Gne curvature gradient, terrain correction density 2.67 g/cm^3	eotvos
34	GUV_Fourier_2p67	Fourier derived Guv curvature gradient, terrain correction density 2.67 g/cm^3	eotvos
35	Drapesurface_Fourier	Drape surface for Fourier reconstruction, smoothed flight surface	metres
36	gD_Fourier_0p0	Fourier derived vertical gravity, no terrain correction applied	mGal
37	GEE_Fourier_0p0	Fourier derived Gee gradient, no terrain correction applied	eotvos
38	GNN_Fourier_0p0	Fourier derived Gnn gradient, no terrain correction applied	eotvos
39	GDD_Fourier_0p0	Fourier derived vertical gravity gradient, no terrain correction applied	eotvos
40	GED_Fourier_0p0	Fourier derived Ged horizontal EW gradient, no terrain correction applied	eotvos
41	GND_Fourier_0p0	Fourier derived Gnd horizontal NS gradient, no terrain correction applied	eotvos
42	GNE_Fourier_0p0	Fourier derived Gne curvature gradient, no terrain correction applied	eotvos
43	GUV_Fourier_0p0	Fourier derived Guv curvature gradient, no terrain correction applied	eotvos
44	gD_Equiv_2p67	Equivalent source derived vertical gravity, terrain correction density 2.67 g/cm^3	mGal
45	GDD_Equiv_2p67	Equivalent source derived vertical gravity gradient, terrain correction density 2.67 g/cm^3	eotvos
46	GNE_Equiv_2p67	Equivalent source derived Gne curvature gradient, terrain correction density 2.67 g/cm^3	eotvos
47	GUV_Equiv_2p67	Equivalent source derived Guv curvature gradient, terrain correction density 2.67 g/cm^3	eotvos
48	Drapesurface_Equiv	Drape surface for equivalent source construction	metres

Table 2: Final HeliFALCON™ AGG Digital Data – ***ASCII and Geosoft Database Format***

File	Description	Units
DTM	Terrain (Referenced to WGS84 Datum)	metres
DrapeSurface_Equiv	Drape surface for equivalent source construction	metres
gD_Equiv_2p67	Equivalent source derived vertical gravity, terrain correction density 2.67 g/cm^3	mGal
gD_Equiv_2p67_conformed	Equivalent source derived vertical gravity, terrain correction density 2.67 g/cm^3 conformed to regional gravity	mGal
GDD_Equiv_2p67	Equivalent source derived vertical gravity gradient, terrain correction density 2.67 g/cm^3	eotvos
DrapeSurface_Fourier	Drape surface for Fourier reconstruction, smoothed flight surface	metres
gD_Fourier_0	Fourier derived vertical gravity, no terrain correction applied	mGal
gD_Fourier_0_conformed	Fourier derived vertical gravity, no terrain correction applied, conformed to regional gravity	mGal
gD_Fourier_2p67	Fourier derived vertical gravity, terrain correction density 2.67 g/cm^3	mGal

gD_Fourier_2p67_conformed	Fourier derived vertical gravity, terrain correction density 2.67 g/cm^3 conformed to regional gravity	mGal
GDD_Fourier_0	Fourier derived vertical gravity gradient, no terrain correction applied	eotvos
GDD_Fourier_2p67	Fourier derived vertical gravity gradient, terrain correction density 2.67 g/cm^3	eotvos

Table 3: Final AGG Grids – *ERMapper Format*