2012 Ground Magnetic Survey

Within the Gipps Creek and Anomaly 370 Projects, Tasmania

Operations and logistics report prepared by Modern Mag ground magnetic surveys.

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1. General Information

1.1 Introduction

In April 2012, Modern Mag was awarded the contract to conduct a ground magnetic survey for TNT Mines Limited within the Anomaly 370 and Gipps Creek projects in Tasmania. This report summarises the survey details, procedures and equipment used by Modern Mag in the acquisition, verification and processing of the magnetic data. Below is a summary of the survey details:

Client	TNT Mines Limited
Modern Mag project number	1005
Survey Areas	Anomaly 370: 5 km north-northwest of Zeehan, Tasmania. Gipps Creek: 16 km north-northwest of Avoca, Tasmania.
Field base	Avoca and Zeehan
Mobilisaton	Monday 7th-Tuesday 8th May, 2012.
Production	8th – 10th and 12th -13th May, 2012
Demobilisation	Monday 14th - Tuesday 15th May 2012

Table 1. Survey details

1.2 Survey Summary

Midday Monday 7th May 2012 the survey crew member mobilised from Horsham to the field base in Avoca. The surveys were conducted between the 8th and 13th of May. The operator returned to Horsham on Tuesday 15th May 2012.

Modern Mag surveyed two grids in this field sortie. The Avoca grid was a test grid without cut lines in a forest. The Zeehan grid was also in dense forest but the lines had been cleared/cut prior to the survey.

Preliminary data checks were performed in the field. Data acquisition was monitored during the survey and digital data was sent each day to the Modern Mag office in Melbourne.

1.3 Survey Personnel

The following Modern Mag personnel were involved with this project:

Title	Name
Project Manager	Justin Ward
Field Manager	Nathan Ward

Table 2. Survey personnel

1.4 Survey Equipment and Specifications

The survey equipment used and specifications were as follows:

Roving magnetometer	GEM GSMP-35 (Sampled at 1 Hz)
Base magnetometer	GEM GSM-19 (Sampled at 5 second intervals)
Station spacing	~1m
Line spacing	100m and 200m
Line direction	90° and 270° (E-W)

Table 3. Survey equipment and specifications

All data was surveyed and acquired in GDA94, MGA 55 south.

1.5 Survey Grid Specifications

The survey grid specifications were as follows:

Grid	Line Spacing	Line Direction	Line-km
Gipps Creek	100m	90^o and 270^o	16.4
Anomaly 370	200m	90^o and 270^o	13.4

Table 4. Survey grid specifications

1.6 Survey location

The location of the grids are shown in the following two figures:

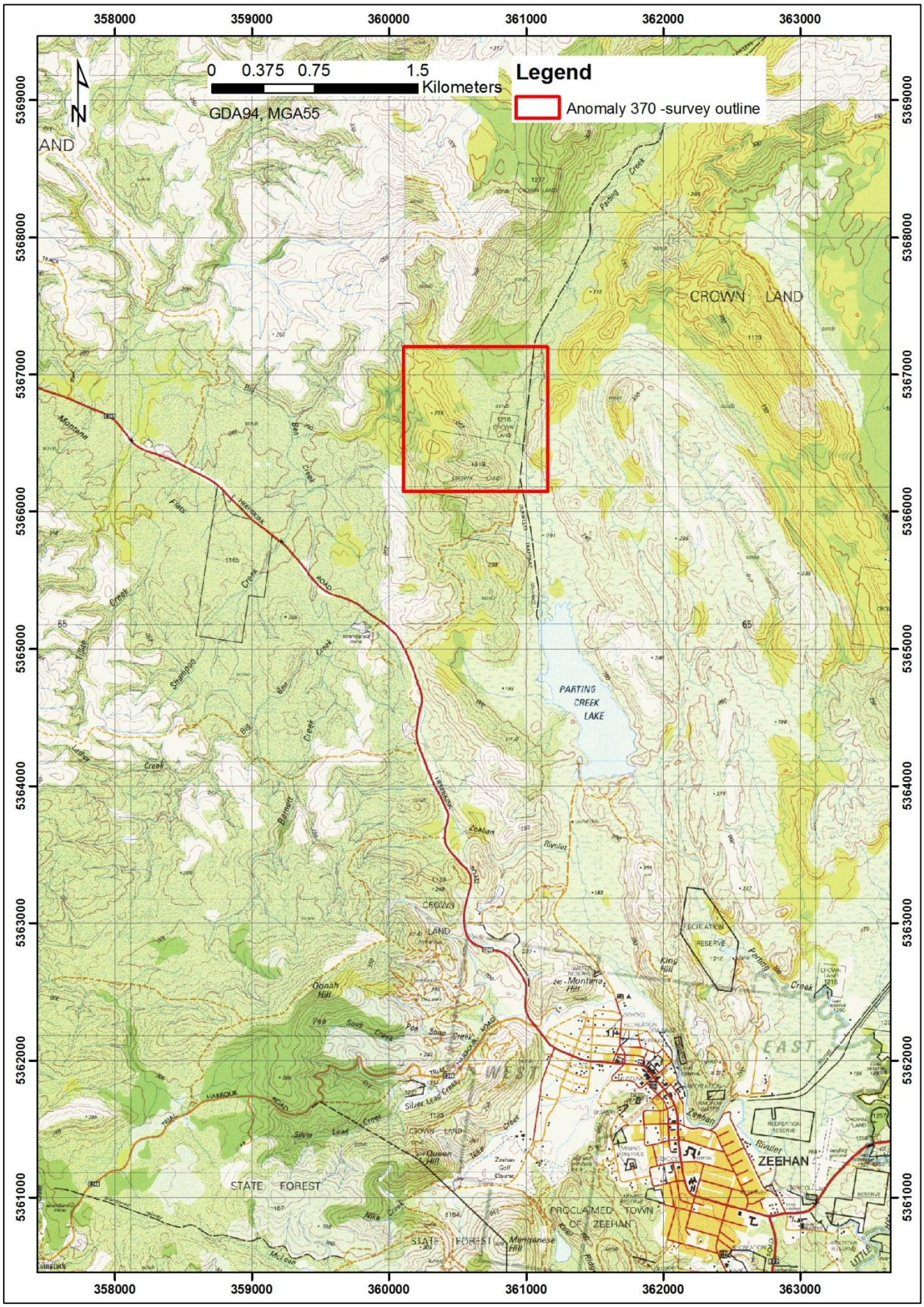

Figure 1. Anomaly 370 survey location

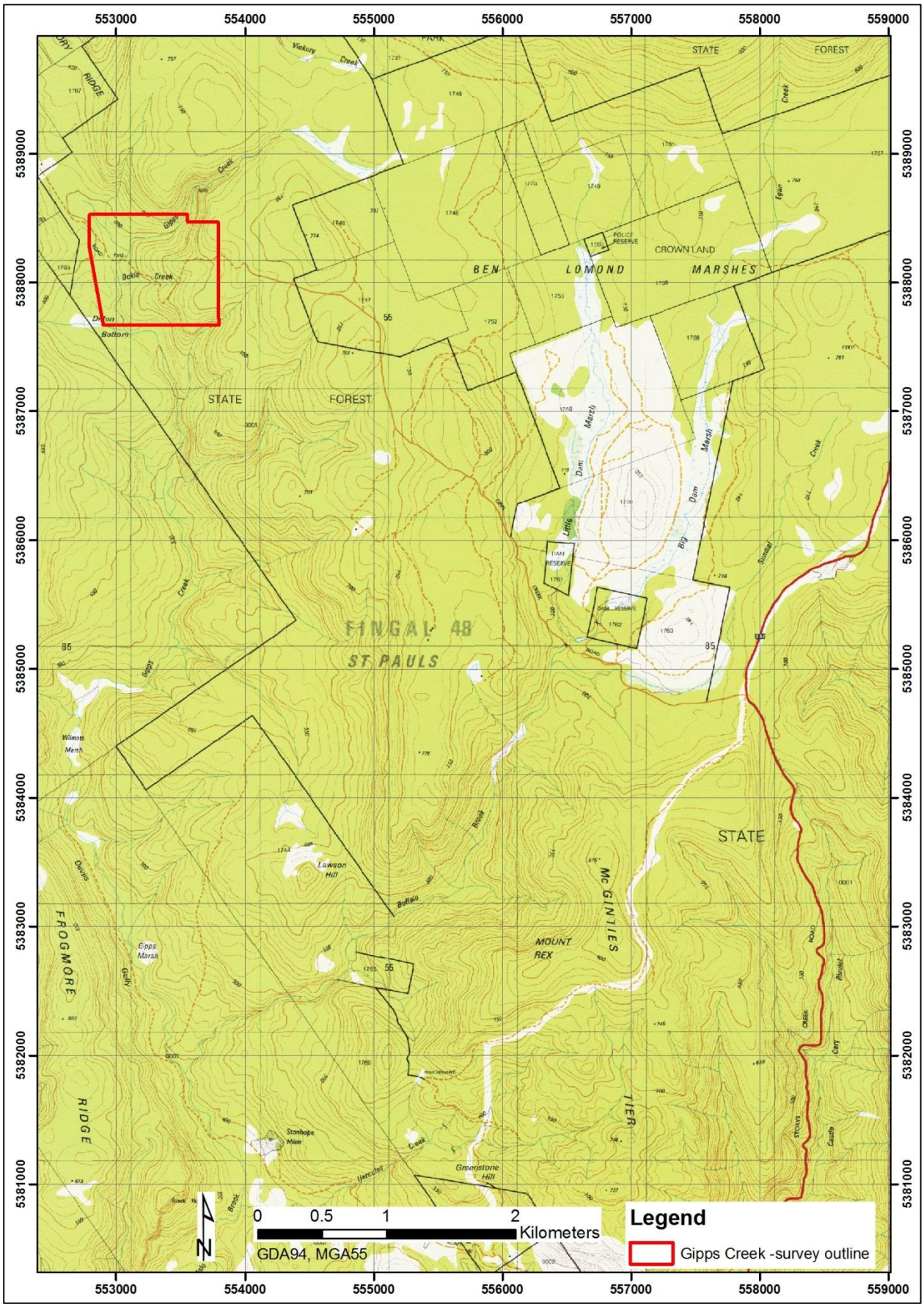

Figure 2. Gipps Creek survey location

2. Production Report

The production was as follows:

Date	Day	Mob/ Demob	Standby	Production	Grid	Comments
7/5/2012	Monday	0.50				Mob from Horsham to Melbourne
8/5/2012	Tuesday	0.75		0.25	Gipps Creek	Mob from Devonport to Avoca. Survey started.
9/5/2012	Wednesday			1.00	Gipps Creek	Rugged terrain in NE of grid.
10/5/2012	Thursday			1.00	Gipps Creek	Rugged terrain and thick forest near creeks.
11/5/2012	Friday	0.75	0.25			Travel to Zeehan. Rain on arrival.
12/5/2012	Saturday		0.75	0.25	Anomaly 370	Rain. Creeks impassable.
13/5/2012	Sunday			1.00	Anomaly 370	Light rain at times did not break canopy.
14/5/2012	Monday	1.00				Demob from Zeehan to Melbourne (Spirit of TAS)
15/5/2012	Tuesday	0.50				Demob from Melbourne to Horsham
		3.5	**1.0**	**3.5**	**TOTALS**	

Table 5. Production report

Rain delayed the surveys several times. The GPS lost lock regularly under the thick tree canopy at anomaly 370, and this slowed production and made processing difficult. There were no environmental or health and safety accidents/incidents. However the vegetation was very lush and the ground was slippery. The operator slipped and fell several times without injury. It is recommended that future ground surveys be conducted in the summer time when the ground is dryer and the creek crossings easier.

Future surveys in this rugged terrains should consider using more robust Overhauser magnetometers. These magnetometers are lightweight and more suited to rough terrain where the sensor cannot always be kept in the same orientation along a line. While these surveys utilised continuous sampling (1Hz), discrete sampling could be considered in future surveys to further improve data quality in rugged terrain.

3. Final magnetic data processing

The following processes were performed on the data:

3.1 Diurnal processing

The raw diurnal data was checked and corrected for spikes. This has not degraded the data at all since the base station was sampled rapidly at 0.2Hz.

3.2 Diurnal correction to the magnetic data

The synchronized digital diurnal data collected by the base station was first subtracted from the corresponding ground magnetic readings and the mean diurnal value added back to the channel. DC shifts that appear within line base station values (*Mag_base*) are due to repeating sections of lines. The diurnally corrected channel is *Mag_corr*. The mean diurnal values for the grids were as follows:

Grid	Mean diurnal value
Gipps Creek	60366.27 nT
Anomaly 370	61805.49 nT

Table 6. Base values for TMI grids

3.3 Data editing and low pass line filter

The *Mag_corr* channel has been manually edited to remove signal dropouts and values where the sensor lost lock. The new edited channel has been called *Mag_corr_edit*. These values have been dummied. However the sensor lock (*li*) channel could be used as a mask to perform the same operation semi-automatically.
Easting and northing values with GPS dropouts have been linearly interpolated. No magnetic values have been interpolated.
A non linear filter with a width of 5 readings was applied to the corrected data (*mag_nfilt*). The final mag channel (*mag_final*) has a 9 point (~9m) low pass filter applied to it.

The Gipps Creek grid contains some lines that were repeated due to noise in the data. These lines have been given the suffix *.1

The anomaly 370 grid contains two sets of lines. One set has been traversed from east to west and the other from west to east. The latter lines have been assigned test status (prefix "s").

3.4 Gridding

The grids have been interpolated with a cell spacing equivalent to $1/4^{th}$ of the line spacing. The minimum curvature algorithm was used to interpolate the line data into a grid.

The *Mag_final* channel in the database has been gridded and presented as *TMI grids. The sun shading inclination and declination are 45^{o}.

3.5 Results

The data quality for the Gipps Creek survey was adversely affected by the extremely rugged terrain, thick vegetation and lack of cut lines. Nonetheless there are interesting geological features in this dataset. The operator reported numerous "old timer" workings in the area surveyed. These diggings run N-S along the western side of the grid, and can more easily be seen in the TMI profile data. This area would best be surveyed in future from the air, or alternatively by using a two man crew with a GSM-19W Overhauser magnetometer. This rugged, lightweight magnetometer would be more suited to this terrain. Future surveys should consider discrete (stop/start) rather than continuous sampling to improve data quality. Continuous sampling and movement of the sensor in rugged terrain degrades the data quality.

The data quality within the anomaly 370 grid was much improved by the presence of cut lines. Given that the operator had to essentially walk every line twice in order to get back to the central cut base line, the entire grid has been surveyed twice, once in each direction. The repeatability of the data is very good, showing that the GSMP-35 has a high absolute accuracy. However the forest canopy at this grid was extremely dense and GPS signal dropouts where common. These dropouts have been linearly interpolated, but some "wander" from the straight cut line can still be seen before the dropout. There are clear geological features in this grid.

4. Deliverables

The data has been provided in the following formats:

Point data:

- Grid corner points have been delivered as *.ply text files.

Line data:

- Geosoft database
- Ascii *.xyz file with file header and line numbers. This is a valid Geosoft XYZ file.
- Grid outlines have been delivered as ArcMap shape, Mapinfo TAB and DXF files.
- Survey path has been delivered as ArcMap shape, Mapinfo TAB and DXF files.

Grid data:

- Geosoft grids
- ERMapper grids
- Mapinfo Tiffs
- ArcMap Tiffs

Maps:

Geosoft maps are the recommended way to view the data from this survey. These maps can be opened with the free Geosoft viewer, or within ArcMap or Mapinfo using the free Geosoft plugins for these products. All these free Geosoft products are included on the data disk attached at the rear of this report.

The data disk in the rear of this report contains the data above as well as a digital copy of this report.

Contractor information

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Grid Plots

Plots of the Gipps Creek and Anomaly 370 grids are included on the following pages.

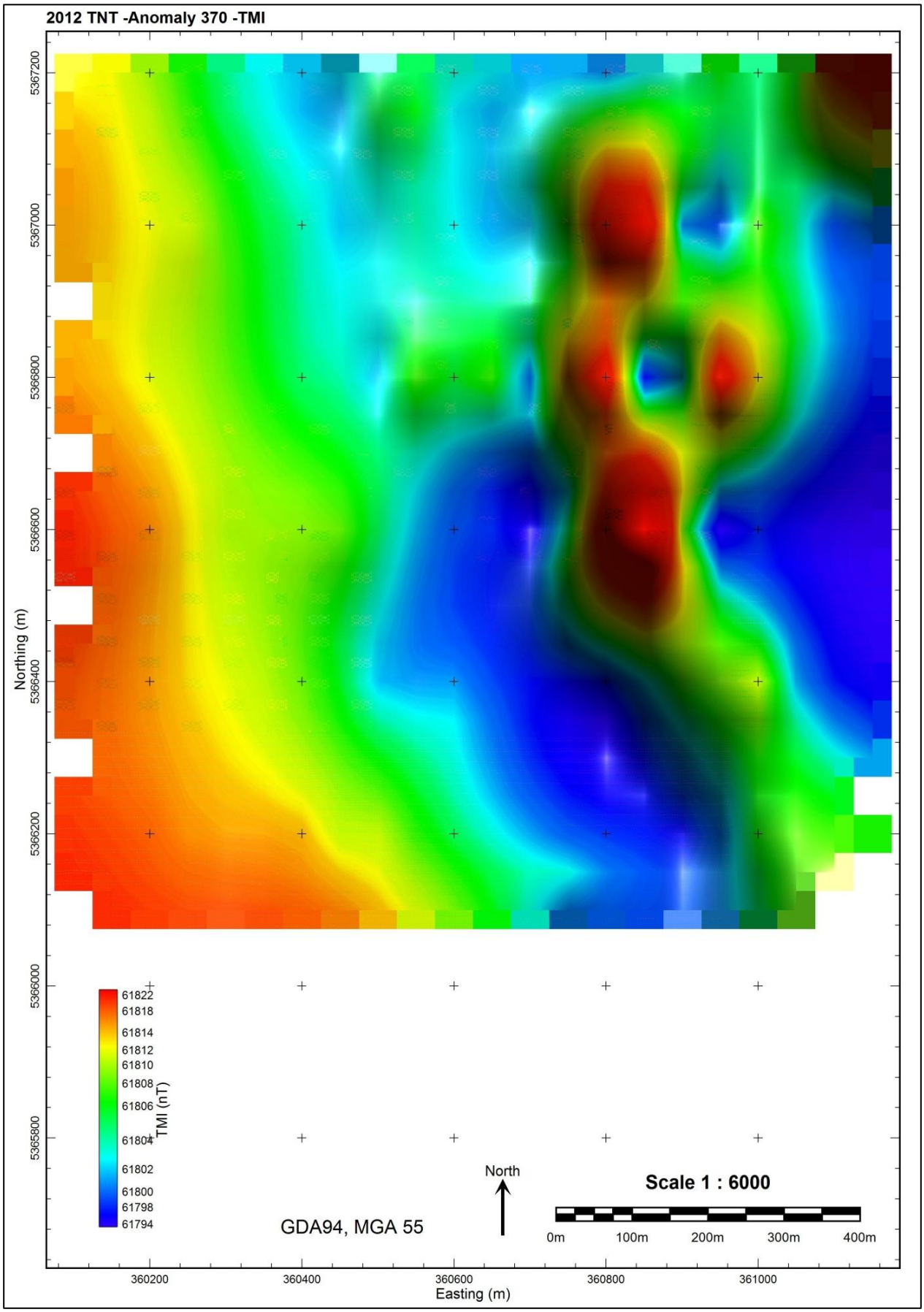

Figure 3. Anomaly 370 Total Magnetic Intensity (TMI)

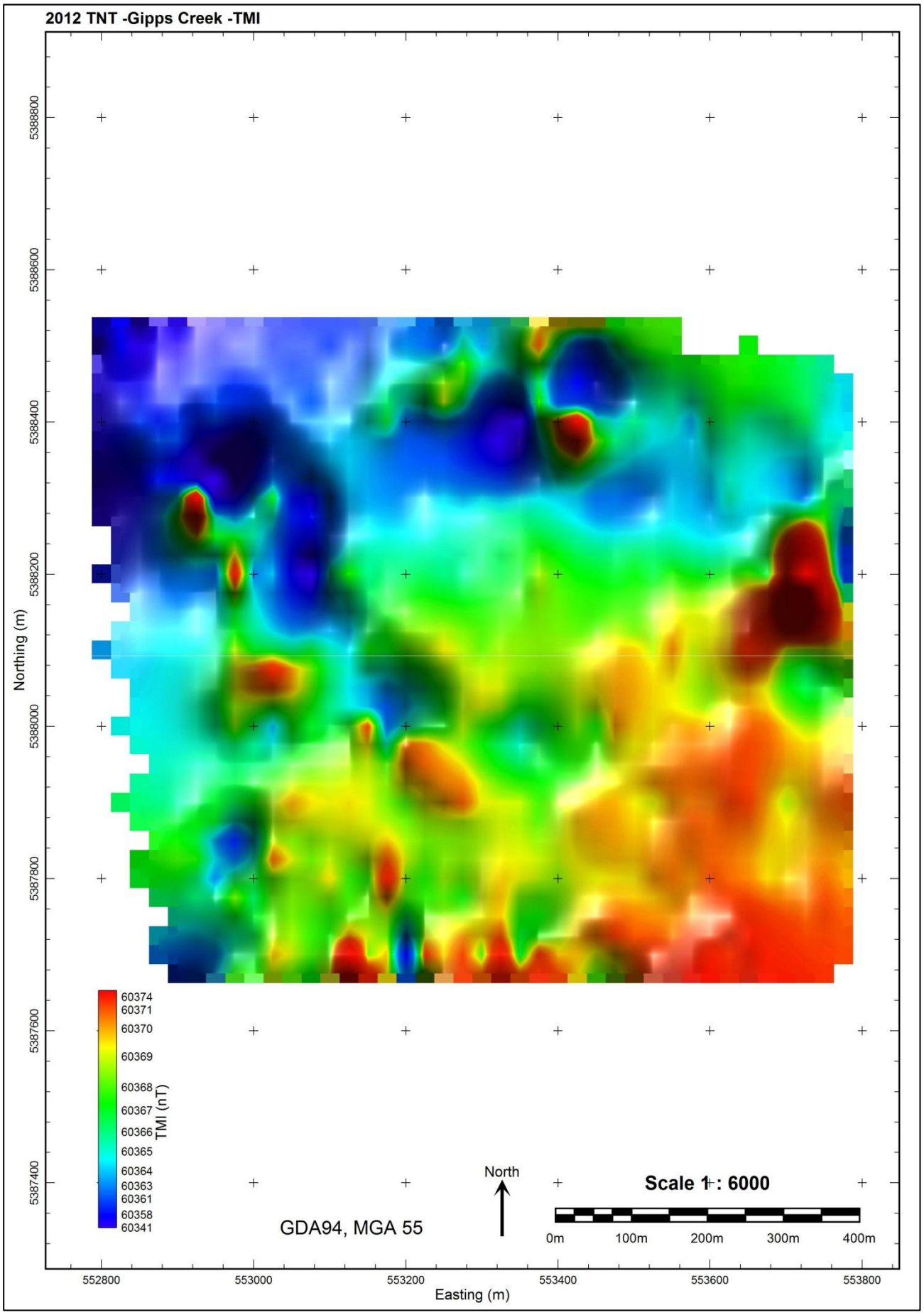

Figure 4. Gipps Creek Total Magnetic Intensity (TMI)