



**Bora Bora  
Resources Ltd**

**2014 Ground Magnetic and VLF Surveys**  
RS Mines and Kingfisher prospects, Sri Lanka

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



**ModernMag**

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# 1. General Information

## 1.1 Introduction

In November 2014, Modern Mag was awarded the contract to conduct ground magnetic and VLF surveys for Bora Bora Resources within the Kingfisher and RS mines projects in Sri Lanka. This report summarises the survey details, procedures and equipment used by Modern Mag in the acquisition, verification and processing of the magnetic and VLF data. Below is a summary of the survey details:

<b>Client</b>	Bora Bora Resources Ltd
<b>Modern Mag project number</b>	1031
<b>Field base</b>	Dambulla
<b>Mobilisation</b>	Friday 5 <sup>th</sup> December – Monday 8 <sup>th</sup> December, 2014.
<b>Production</b>	Wednesday 12 <sup>th</sup> – Thursday 27 <sup>th</sup> March, 2014
<b>Demobilisation</b>	Friday 19 <sup>th</sup> December – Sunday 21 <sup>st</sup> December, 2014

Table 1. Survey details

## 1.2 Mobilisation and Demobilisation

Midday on Friday 5<sup>th</sup> December, 2014 the survey crew mobilised from Horsham. Victoria. The crew arrived at Dambulla, Sri Lanka on Saturday 6<sup>th</sup>, and travelled to Dambulla on Sunday 7<sup>th</sup>. Monday 8<sup>th</sup> was time spent with site familiarisation and VLF testing. The crew was on contractor standby from Tuesday 9<sup>th</sup>, to Saturday 13<sup>th</sup>, 2014 due to a missing GPS system. The surveys were conducted between the 14<sup>th</sup> and 18<sup>th</sup> of December. The crew demobilised back to Horsham on Friday 19<sup>th</sup>, arriving back at base midday on Sunday 21<sup>st</sup> December.

## 1.3 Survey Personnel

The following Modern Mag personnel were involved with this project:

<b>Title</b>	<b>Name</b>
Project Manager	Justin Ward
Field Manager	Nathan Ward
Field assistants	Loki McIntyre

Table 2. Survey personnel

## 1.4 Survey Equipment and Specifications

The survey equipment used was as follows:

<b>Roving magnetometer</b>	GEM GSMP-35
<b>Base magnetometer</b>	GEM GSM-19 (Sampled at 3 second intervals)
<b>Station spacing</b>	~1m (1Hz sampling)
<b>Line spacing</b>	10m
<b>Line direction</b>	0° and 180°.

Table 3. Survey equipment and specifications

All data was surveyed and acquired in UTM 44 North.

## 1.5 Survey Grid Specifications

The survey grid specifications were as follows:



Grid	Line Spacing	Line Direction	Line-km (actual)
RS mines	10m	0° and 180°	1.9 l-km

Table 4. Survey grid specifications

The terrain on both grids was quite rugged and the vegetation was thick and impenetrable in some locations. Hence line cutting was undertaken at both sites. Regardless some areas remained impenetrable which explains the irregular line spacing, particularly on the RS Mines grid.

The Modern Mag crew reported that the lines cutters did a good job.

### 1.6 Survey location

The location of the grids are shown in the following figure.

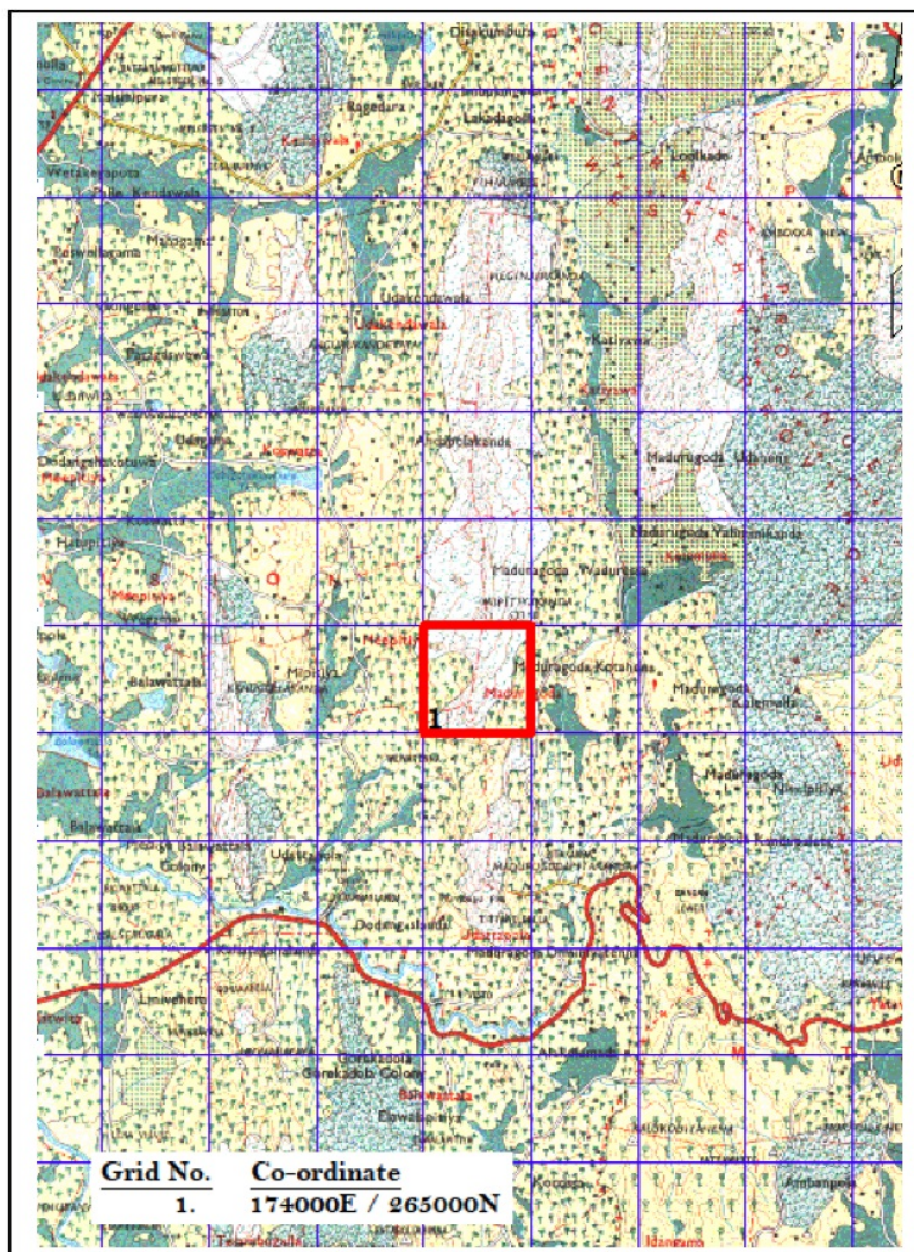


Figure 1. Survey location

## 2. Production Report

The production was as follows:

Date	Day	Mob/ Demob	Standby	Production	Downtime / days off	Grid	Comments
5/12/2014	Friday	0.5					Travel from Horsham to Melbourne
6/12/2014	Saturday	1.0					Australian to Sri Lanka
7/12/2014	Sunday	1.0					Columbo to Dambulla and Kingfisher visit
8/12/2014	Monday		1.0				Site familiarisation and VLF trial with AJ
9/12/2014	Tuesday				1.0		Modern Mag awaiting GPS part. AJ with VLF on-site.
10/12/2014	Wednesday				1.0		Day off.
11/12/2014	Thursday				1.0		Day off
12/12/2014	Friday				1.0		Day off
13/12/2014	Saturday				1.0		Drive to Connugulla to pick up part and then to RF mine to pick up Mike and drive back to Dambulla.
14/12/2014	Sunday			1.0		RS Mines	Ground mag and VLF at RS Mines.
15/12/2014	Monday			1.0			
16/12/2014	Tuesday			1.0			
17/12/2014	Wednesday			1.0			
18/12/2014	Thursday			1.0			
19/12/2014	Friday	1.0					Morning rain then travel to Columbo.
20/12/2014	Saturday	1.0					Columbo accommodation to airport
21/12/2014	Sunday	0.5					8am leave airport and drive to Horsham.
		<b>5.0</b>	<b>1.0</b>	<b>5.0</b>	<b>5.0</b>	<b>TOTALS</b>	

**Table 5. Production report**

There were no environmental accidents/incidents during the duration of the project. The vehicle provided had very worn out tires and it slipped off a dirt road one day. It is recommended that off road vehicles have suitable tires. Where possible, Modern Mag crew should drive 4WD vehicles in off-road conditions. Modern Mag crew have formal advanced training and extensive experience. They are certain that if they were driving they would not have run off the road in this instance.

There were 5 mobilisation/demobilisation days. There was one standby day that equated to site familiarisation and VLF training.

There were 5.0 days of surveying. The crew endured working in the rain on many days so that production could be increased after the initial delay caused by a missing GPS part.

Production rates were better than expected given the rough terrain, thick vegetation and steady rain on many production days. Modern Mag crew endured the rain for the benefit of the client. They were not however able to work in driving rain like on Friday 19<sup>th</sup>. It is recommended that field work be conducted in dryer seasons in the future.

## 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 3 second intervals.

### 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 value for the grid was as follows:

Grid	Mean diurnal value
RS Mines	40940.73 nT

Table 6. Base values for TMI grid

### 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. These values have been dummied. However the *Mag\_lock* channel could be used as a mask to perform the same operation semi-automatically. *Mag\_lock* values of 1 represent locked magnetic readings.

There were no GPS dropouts during the survey. No magnetic values have been interpolated. A non-linear filter with a width of 3 was applied to the corrected data (*Mag\_filt*).

### 3.4 Gridding

The grid has been interpolated with a cell spacing equivalent to 1/4<sup>th</sup> of the line spacing. Since this grid has a 10m line spacing, a 2.5m cell size has been used for all grid interpolation. The *Mag\_filt* channel has been gridded. A minimum curvature algorithm was used to interpolate the data.

The *Mag\_filt* channel has been gridded and presented as \*TMI grids. The sun shading inclination and declination is 45°.

## 4. Very Low Frequency (VLF) data

VLF data was acquired at both projects. A geonics EM16 was used to acquire the VLF data and the position of the stations (recording points) was recorded with a garmin GPS60. The analog readings were recorded and later transposed to an MS Excel spreadsheet. These spreadsheets were converted to Geosoft Oasis Montaj and ASCII databases.

Many VLF sources were considered in this survey, but the 1 Megawatt Australian station at Exmouth in Western Australian provided the clearest signal. Nonetheless, this signal was difficult to detect at the RS Mines site

One line was surveyed twice at the RS mines site. The second time the line was shorter.

The location of the stations has also been plotted on the Geosoft Maps.

## 5. 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 Plot**

Plots of the 3 grids are included on the following pages. They are TMI images with the location of the VLF stations shown as black squares.

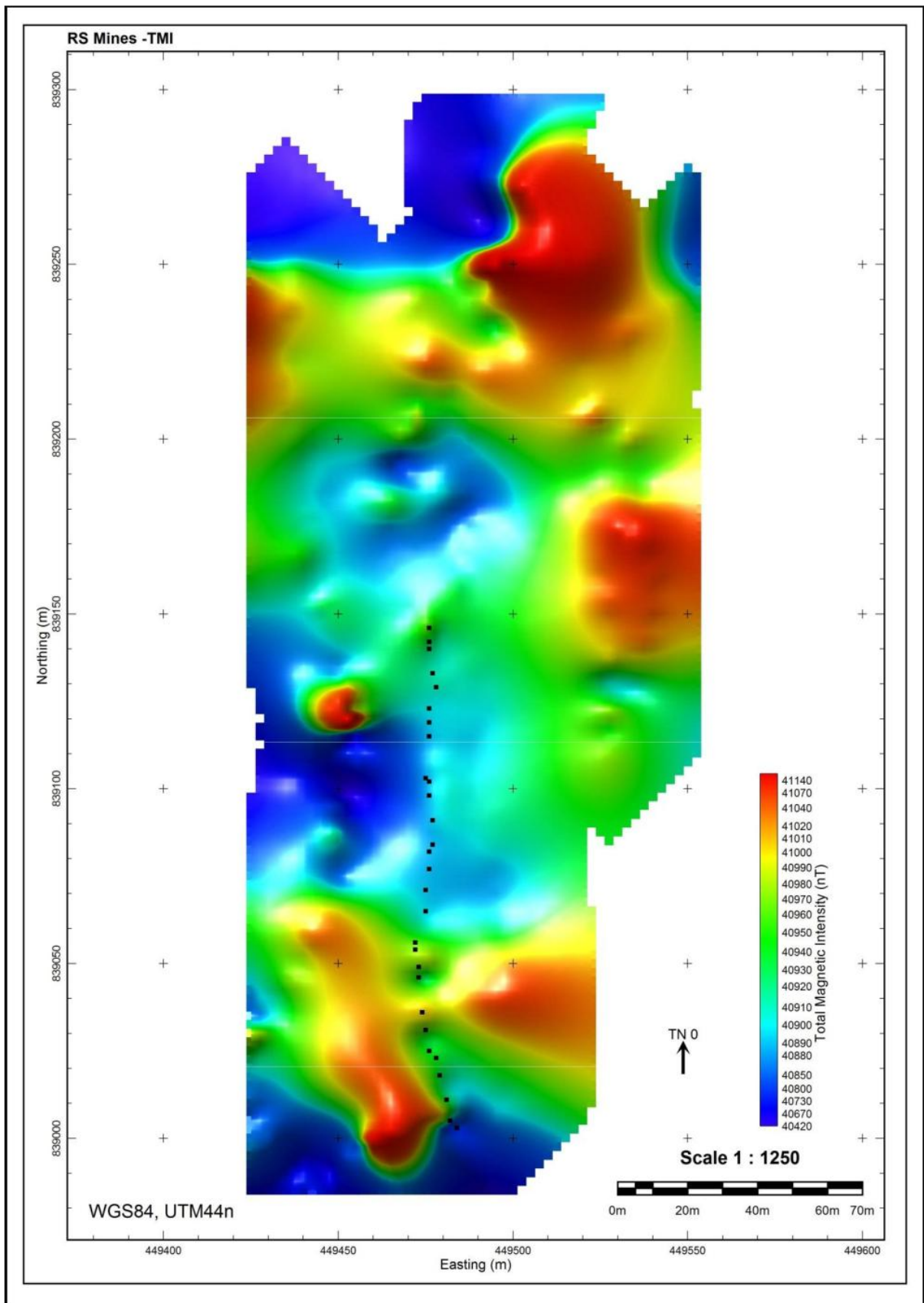


Figure 2. RS Mines TMI with VLF stations (black)