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MEMORANDUM

To:	Mr Gary Price, Chairman *via* email: gary@bowganl.com.au	**Affiliation:**	Bowgan Minerals Ltd 128/625Castlereagh St, Sydney NSW 2000
From:	J.E. Hanneson	**Costing:**	
Date:	3 July, 2016	**Reference:**	AMG16/01
Subject:	**Ground Magnetic Images for the Neutral Junction Prospect, Bowgan Minerals Ltd., Northern Territory**		

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1. PREAMBLE

This brief report presents images of ground magnetic data from the Neutral Junction area of the Northern Territory. The data is comprised of two groups, four surveys carried out in 2006, 2007, 2010 and 2011 by the previous lease holder and compiled and diurnally corrected by Hawk Geophysics Pty Ltd. The second group of surveys was carried out by Bowgan Minerals Ltd in 2014 and 2015a,b.

No interpretation or modelling is provided at this time and the following notes are intended as reminders for the writer of the processing steps needed. The most time consuming aspect of the work was in standardising the format of the many daily data dumps of both base station and rover magnetometers so that the files could be read and merged and finally concatenated into a single file for processing and plotting. The collection of future data to a consistent format will greatly reduce the effort required to produce images.

2. DATA

Neutral Junction: Hawk Geophysical Data

The files indicated in Table are reformatted versions of the diurnally corrected ground magnetic data collected, corrected and concatenated by Hawk Geophysics in 2006, 2007, 2010 and 2011. The information is included in the archive file (***name ***)provided with this report)and the separate files can be identified by the survey code (first 12 characters on each record) which includes the survey date.

Table 1.

File Name	File size	Station Interval
2006_HWK.MA2	373,641	20 m
2007_HWK.MA2	125,241	20 m
2010_HWK.MA2	780,081	20 m
2011_HWK.MA2	5,593,641	*c.* 0.3 m

Additional daily data dumps of base and rover magnetometer were found in the original data archive for 13, 14 and 15 May, 2011, that were not included in the above file 2011_HWK.MA2. With no operations report, some effort was expended discovering firstly that the data hadn't been included in the

compilations and secondly that the May survey, in fact, collected no useable data. Data for 13 May was found to have a base station file but no spatial coordinates for the rover stations; and, data for 15 May had Lat/Longs for coordinates but no base station data. Finally, data for 14 May included both base and rover station files but the base file contained times in a .csv that reported only minutes and seconds. The hour, required for correlation with the rover file, could not be recovered.

Neutral Junction: Bowgan Minerals Ground Magnetic Data

Data was collected at Neutral Junction by Bowgan Minerals in October 2014, June 2015 and July 2015 and provided to the writer as daily dumps of base station and rover magnetometer files in Microsoft Excell *.xls* format. The sequence of columns in the files, as well as the styles in which date and time were recorded was variable, and line numbers were redundant. Effort was expended to make the data conform to a single standard that could be read unambiguously and without error by the writer's data processing software.

After reformatting and grouping of files by survey month, the magnetic field values measured at the base station were used to obtain an average value for the base station. Subtracting the mean then gave an estimate of magnetic drift for each base reading at 30-second intervals. Each reading of the rover magnetometer and its time was then corrected by subtracting the base station drift value for the nearest corresponding time. It is assumed that the same base station was used for all rover readings, but this has not been confirmed.

The following files derive from diurnally corrected but decimated (1 in 10) data. The original half-second rover sampling intervals generated readings spaced at less than a metre and creates redundancy and unnecessarily large data files. Consequently the rover were decimated to select one in every ten readings, so that after merging the final diurnally-corrected files creating a survey station every 7 or 8 metres depending on the operator's pace.

The Bowgan Minerals data from three surveys is included in the following files:

Table 2.

File Name	File Size	Station Spacing
NJ_2014.MA1	1,030,273	7 to 8m
NJ_2015A.MA1	1,962,547	7 to 8m
NJ_2015B.MA1	1,350,846	7 to 8m

The above files were concatenated and tested, with a further revision required to weed out a small number of records found to have coordinate of (0E,0N) with the final step being decimation to produce the 7-8 m readings in file NJ____EN.DEC.

Figure 1.1 is a plot of data resulting from a simple concatenation of the Hawk Geophysical (2006, 2007, 2010, 2011) data with the 2014 and 2015 data collected by Bowgan Minerals. The latter dataset comprises reading to the south and east of (420000E, 7580000N).

3. DISCUSSION AND CONCLUSION

The rather unsatisfactory image in Figure 1.1 seems to warrant a further assessment of the data.

Statistical Assessment of the diurnally corrected Hawk and Bowgan data

The very low readings in the central part of the Bowgan data prompted a statistical assessment of the magnetic field values which is summarised in Table 3

Table 3. Statistical Report; magnetic field values in diurnally corrected data.

File	Field	Column	Min	Max	Average	Std Dev	Records
NJ_HAWK.DAT	1	68- 79	0.5000000E+01	0.5400720E+05	0.5213626E+05	0.4800782E+03	15321
NJ_BOWG.DAT	1	68- 79	-0.1331716E+04	0.8683783E+05	0.5205098E+05	0.3847774E+04	28766
NJ___EN.DAT	1	68- 79	-0.1331716E+04	0.8683783E+05	0.5208179E+05	0.3111499E+04	44082

While the maximum value in each of the three files might be reasonable near exceptionally magnetic rocks, it is improbable that the minimum values of 5.00000 nT in one case and -1332 nT in the other two are correct -- even in the presence of extreme magnetic remanence. The source of the supposed error remains unidentified at this time, but may relate to drop-outs in either the base or rover station records (or both).

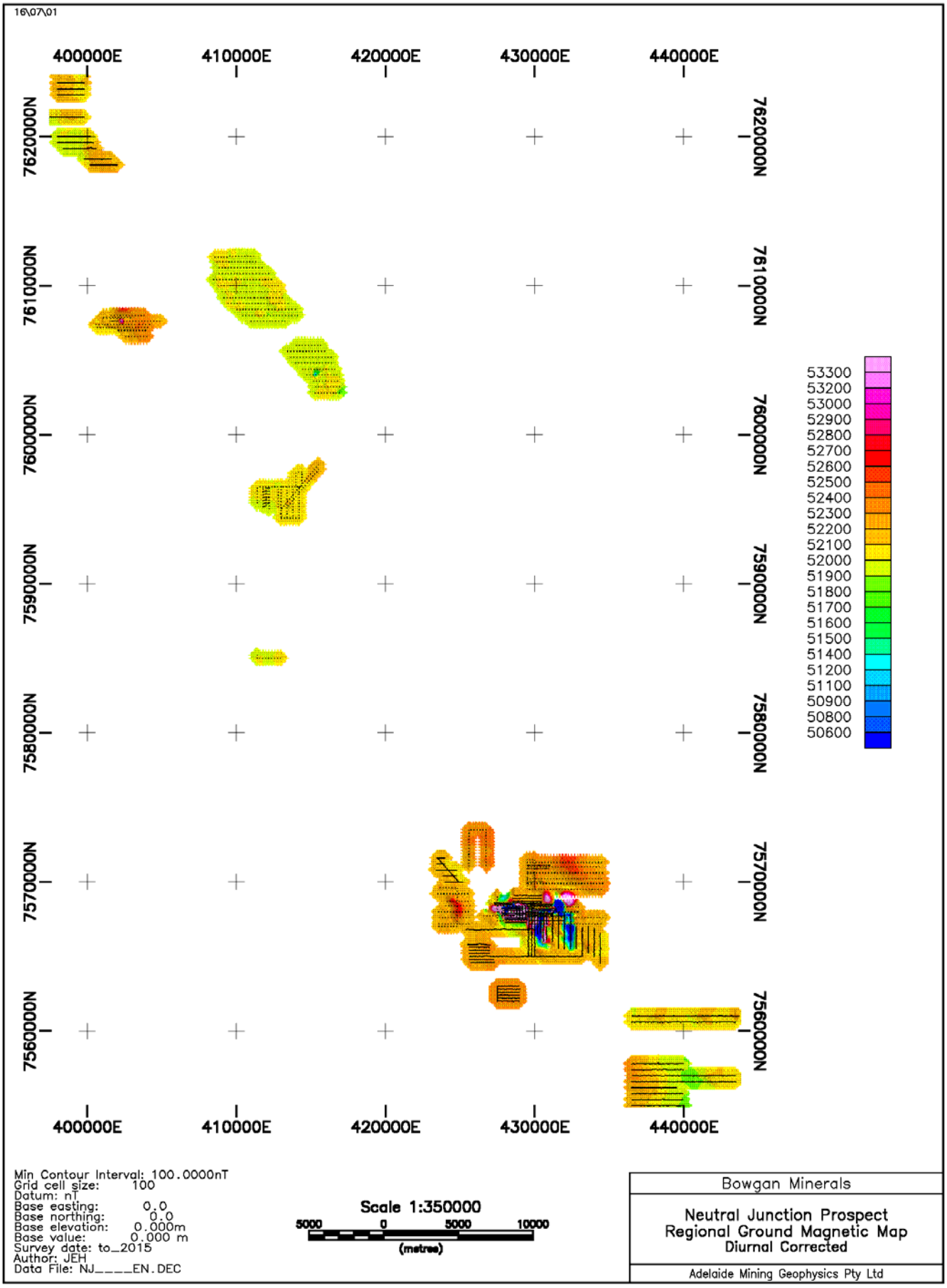
As an initial test, the Bowgan readings used to create images were restricted to those that are within three standard deviations of the mean, which, theoretically, comprises about 99 percent of the data if the distribution is Gaussian. In the case of the combined data (line 3, Table 3, red) it includes data in the range 42747 to 61416 nT. When the data was windowed to this range it resulted in the removal of 609 stations, retaining 43473 stations or 98.6 percent as estimated for a supposed Gaussian distribution. After trimming the data the regional shown in Figure 1.1 (all corrected data, including that collected by Hawk Geophysics) appears as shown in Figure 1.2.

In the writer's opinion the image in Figure 1.2 is only slightly better than that in Figure 1.1 and many readings in the central part of the Bowgan data appear to be too low.

Recommended Image for interpretation purposes

The Bowgan data is shown alone in the expanded image in Figure 2, where there appear to be mismatched survey segments. On the assumption that either (or both) of the base and rover magnetometers have segments of data that yield an invalid diurnal correction, the uncorrected data (within three standard deviations of the mean) was plotted and is shown in Figure 3.1. This image is suddenly believable; it is recommended for interpretation -- at least, until more or replacement data can be obtained. By way of further processing, the image in Figure 3.1 was smoothed via 32 passes of the default Geosoft Hanning filter to produce the smoothed image shown in Figure 3.2. If the smoothed image is taken as the response of deep-seated or regional trends, then subtracting the smoothed image from the original image yields the residual magnetic image in Figure 3.3. Residual images enhance shorter wavelength features more likely to be of economic interest.

If it is assumed that diurnally uncorrected data can be useful, there are two lines of Hawk Geophysical data (May 2011) that could be included in the present data set, but which hasn't been done due to time constraints. Creating again the regional image using the uncorrected Bowgan data yields Figure 4.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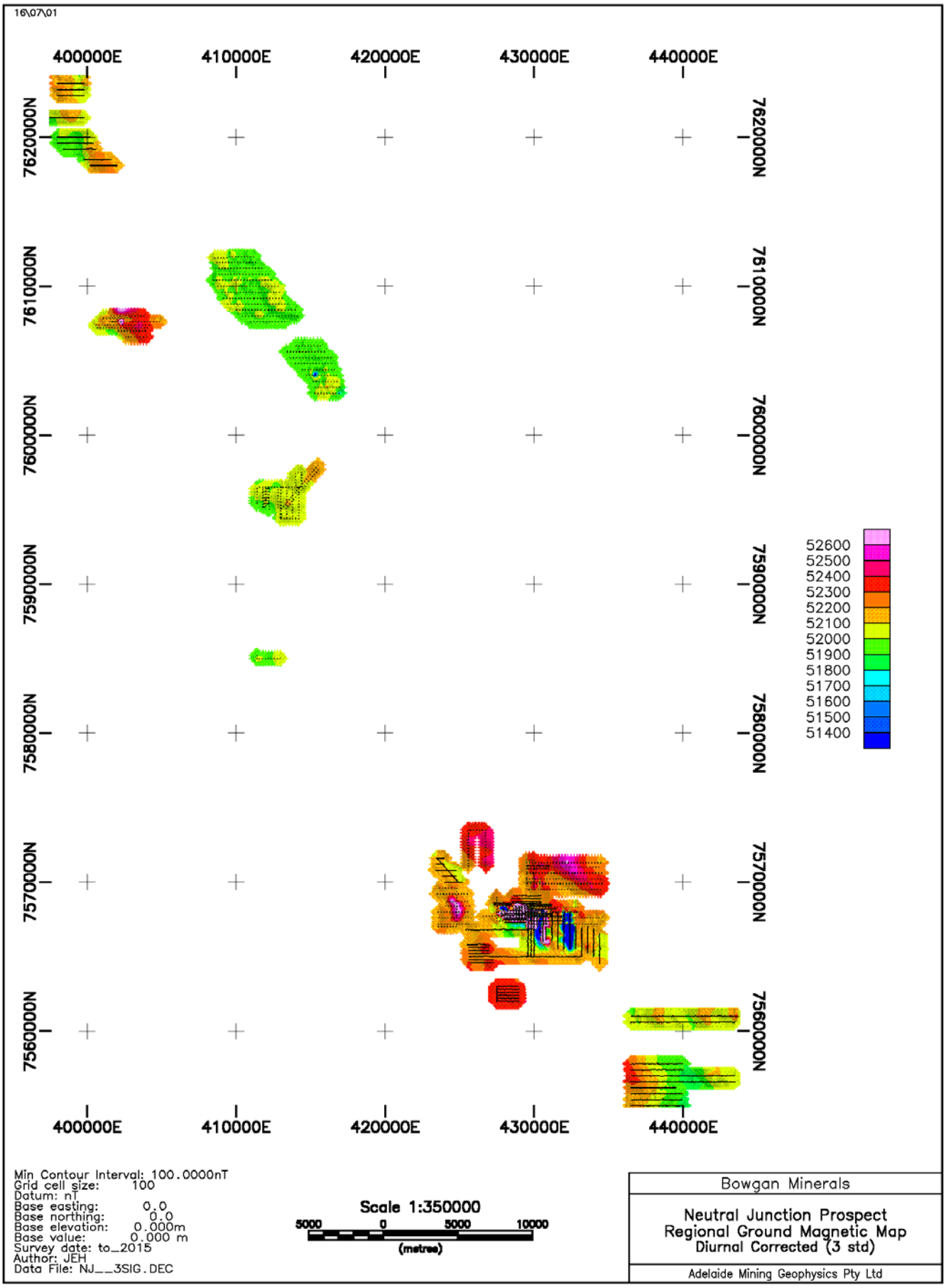
Grid cell size: 100
Datum: nT
Base easting: 0.0
Base northing: 0.0
Base elevation: 0.000m
Base value: 0.000 m
Survey date: to_2015
Author: JEH
Data File: NJ____EN.DEC
Scale 1:350000
5000 0 5000 10000
(metres)
Bowgan Minerals
Neutral Junction Prospect
Regional Ground Magnetic Map
Diurnal Corrected
Adelaide Mining Geophysics Pty Ltd

Figure 1.1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Base value: 0.000 m
Survey date: to_2015
Author: JEH
Data File: NJ__3SIG.DEC
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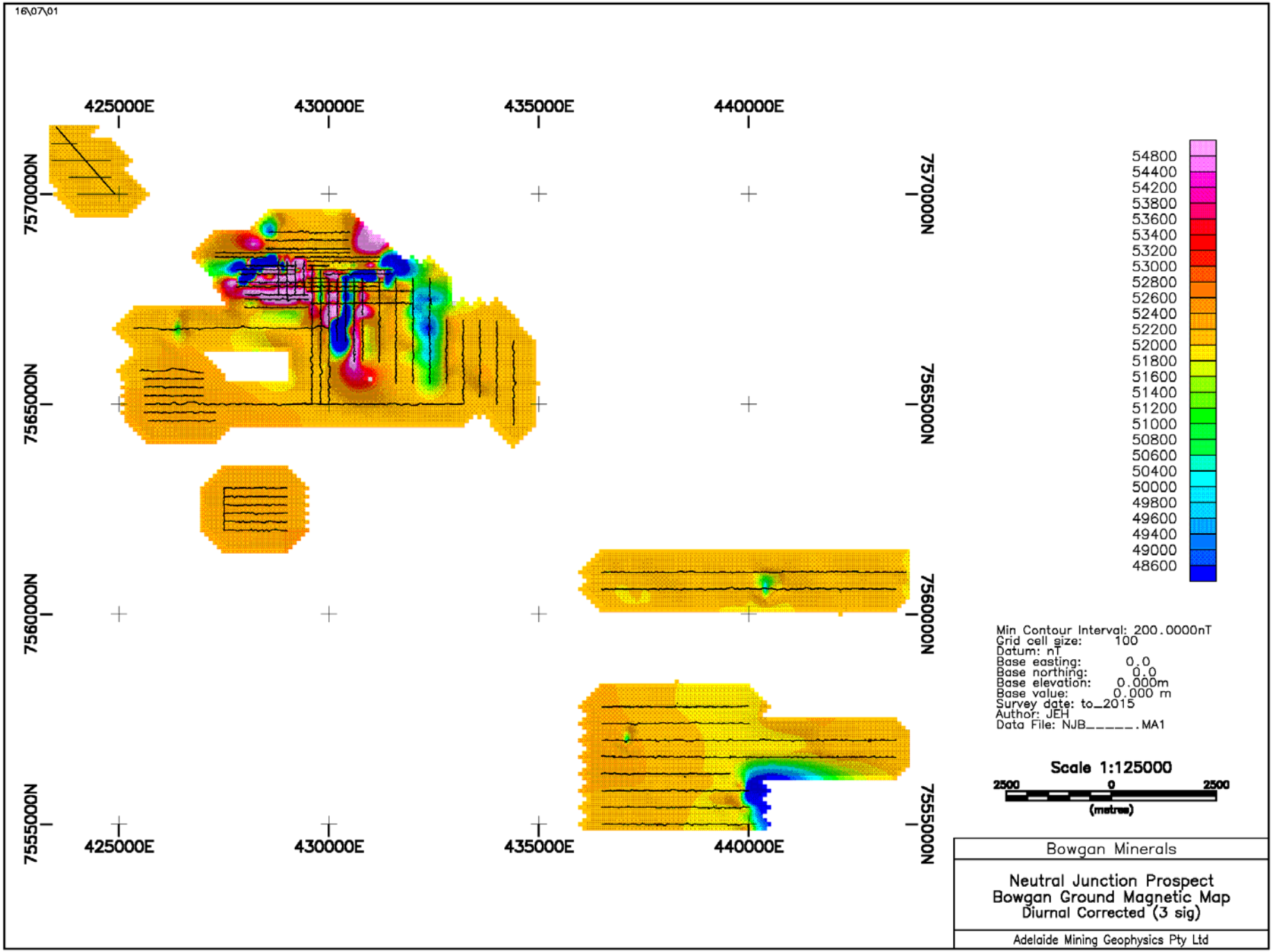
(metres)
Bowgan Minerals
Neutral Junction Prospect
Regional Ground Magnetic Map
Diurnal Corrected (3 std)
Adelaide Mining Geophysics Pty Ltd

Figure 1.2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Grid cell size: 100
Datum: nT
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Base northing: 0.0
Base elevation: 0.000m
Base value: 0.000 m
Survey date: to_2015
Author: JEH
Data File: NJB_____.MA1
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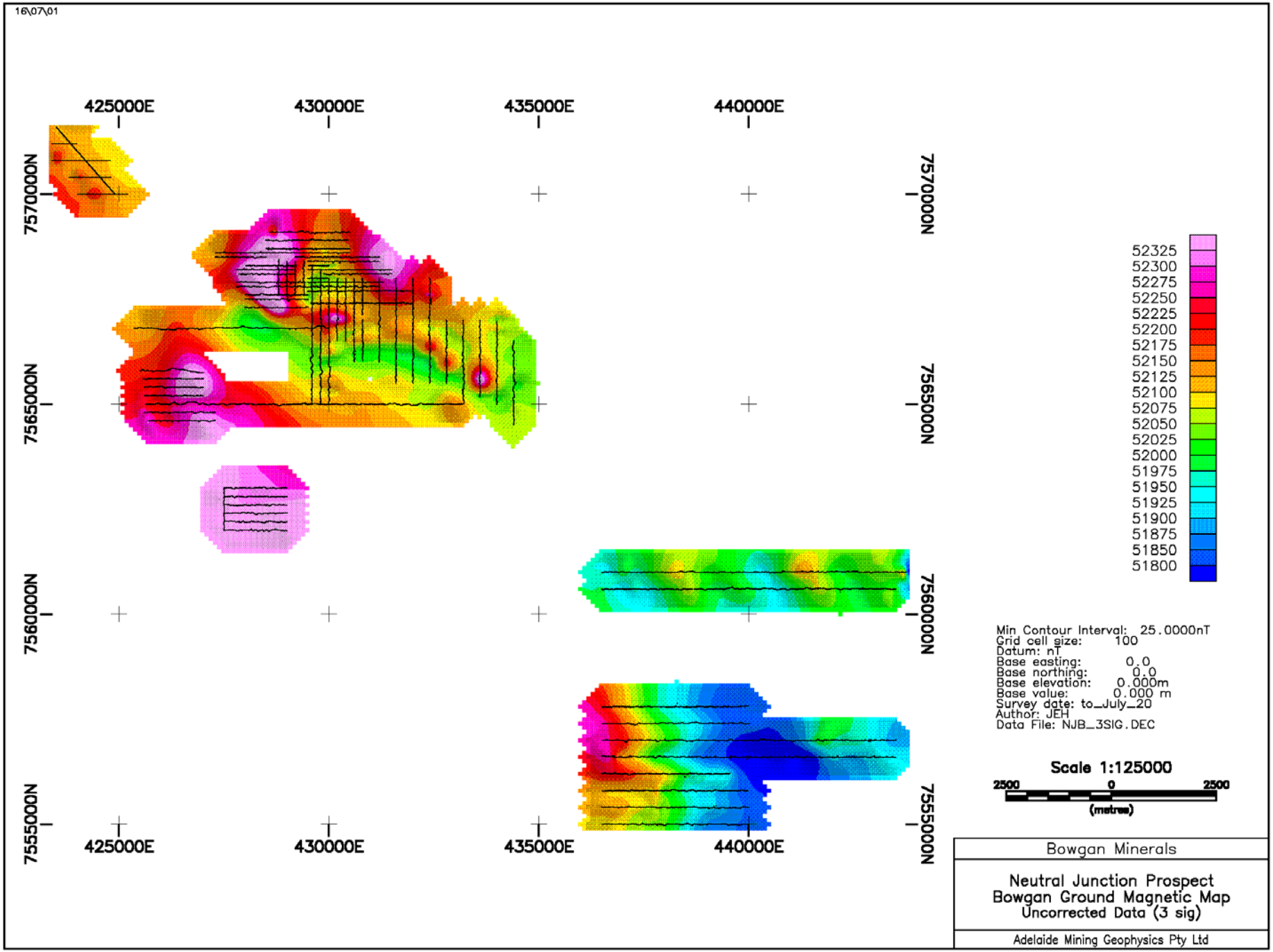
(metres)
Bowgan Minerals
Neutral Junction Prospect
Bowgan Ground Magnetic Map
Diurnal Corrected (3 sig)
Adelaide Mining Geophysics Pty Ltd

Figure 2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Grid cell size: 100
Datum: nT
Base easting: 0.0
Base northing: 0.0
Base elevation: 0.000m
Base value: 0.000 m
Survey date: to_July_20
Author: JEH
Data File: NJB_3SIG.DEC
Scale 1:125000
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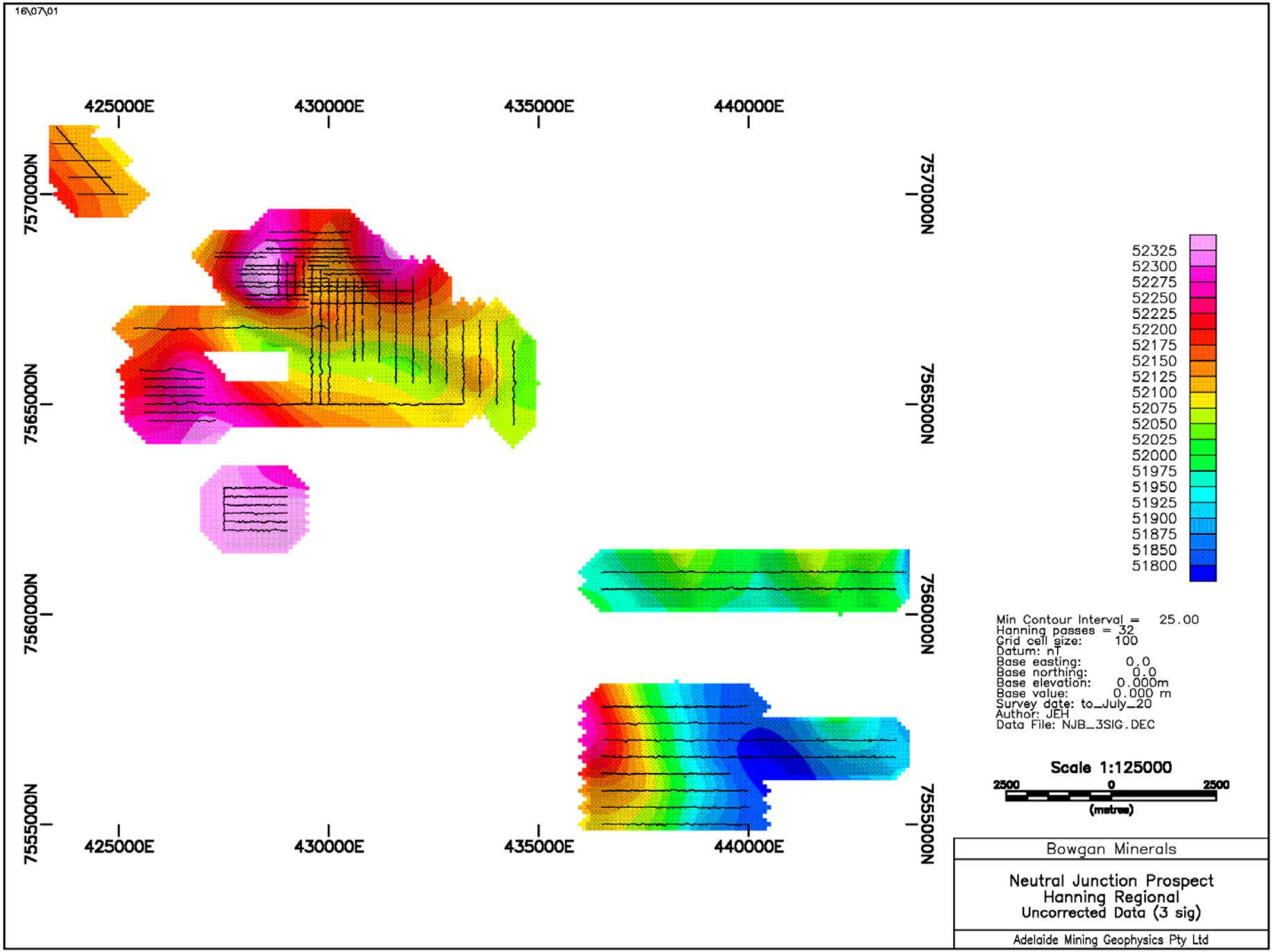
(metres)
Bowgan Minerals
Neutral Junction Prospect
Bowgan Ground Magnetic Map
Uncorrected Data (3 sig)
Adelaide Mining Geophysics Pty Ltd

Figure 3.1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Grid cell size: 100
Datum: nT
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Base northing: 0.0
Base elevation: 0.000m
Base value: 0.000 m
Survey date: to_July_20
Author: JEH
Data File: NJB_3SIG.DEC
Scale 1:125000
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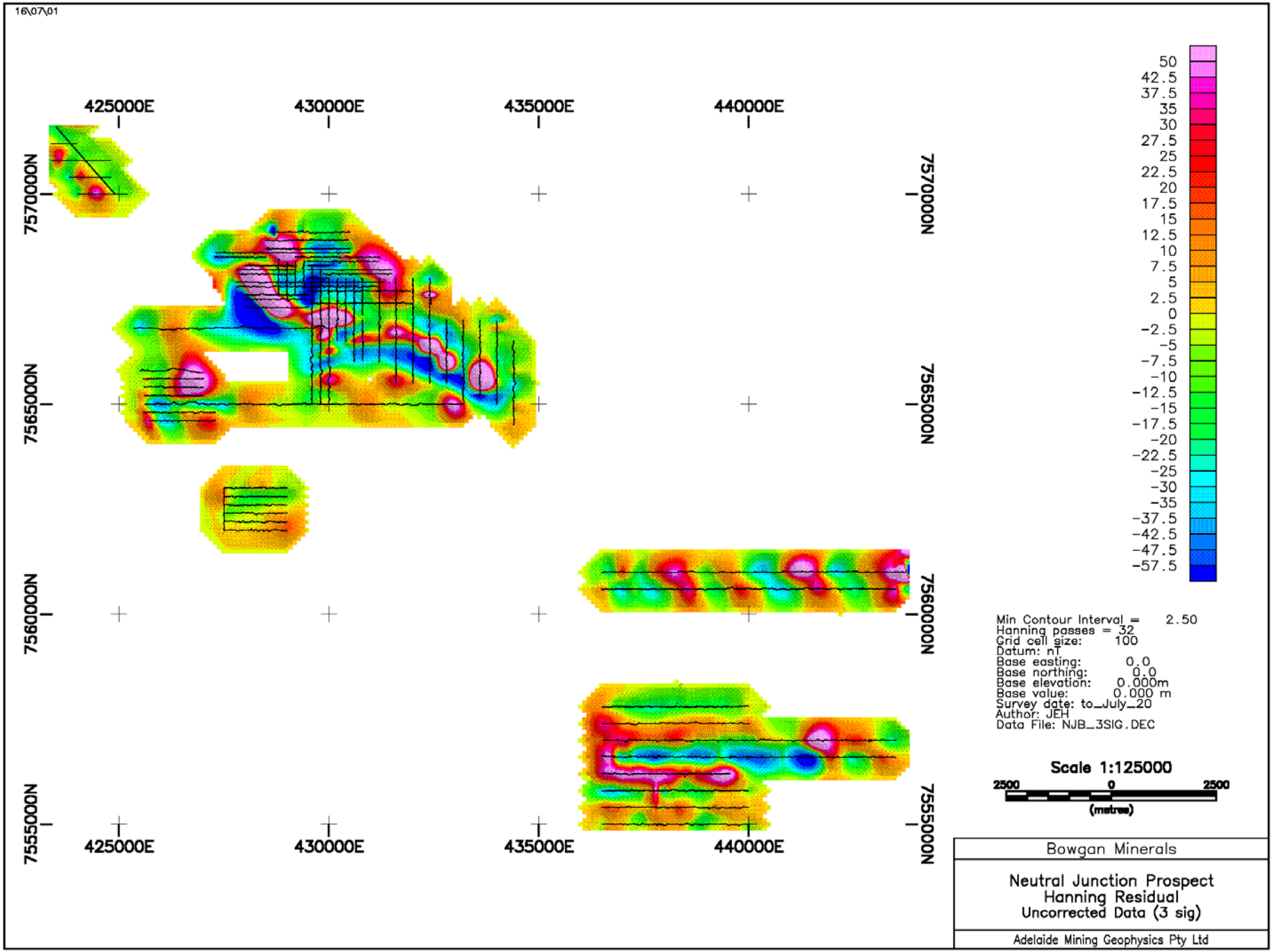
(metres)
Bowgan Minerals
Neutral Junction Prospect
Hanning Regional
Uncorrected Data (3 sig)
Adelaide Mining Geophysics Pty Ltd

Figure 3.2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Hanning passes = 32
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Base northing: 0.0
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Base value: 0.000 m
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Author: JEH
Data File: NJB_3SIG.DEC
Scale 1:125000
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0
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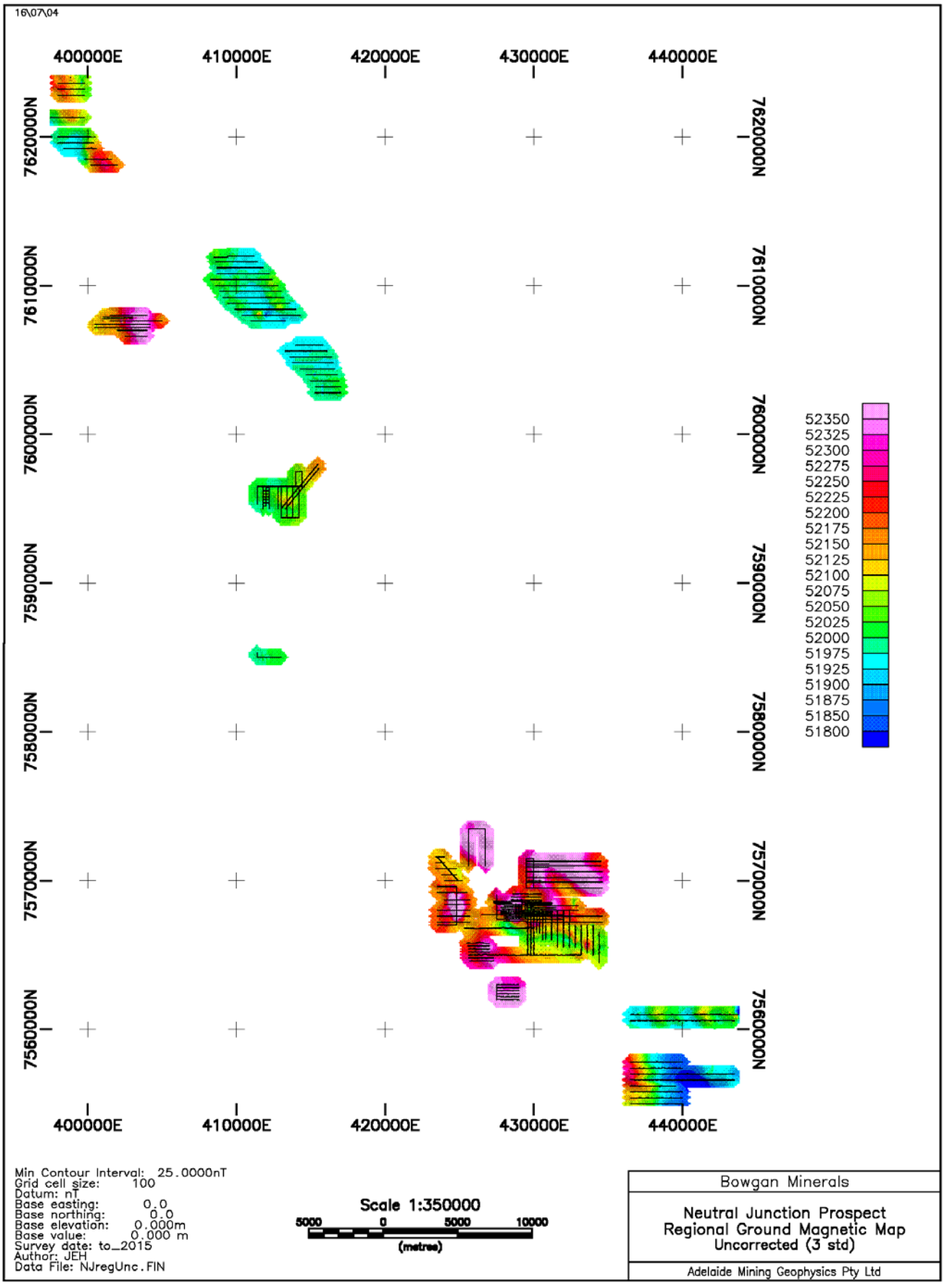
(metres)
Bowgan Minerals
Neutral Junction Prospect
Hanning Residual
Uncorrected Data (3 sig)
Adelaide Mining Geophysics Pty Ltd

Figure 3.3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(metres)
Bowgan Minerals
Neutral Junction Prospect
Regional Ground Magnetic Map
Uncorrected (3 std)
Adelaide Mining Geophysics Pty Ltd

Figure 4