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EL 5068

KOOMOOLOO

FIRST PARTIAL SURRENDER REPORT FOR THE PERIOD 12/4/2007 TO 15/1/2013

Submitted by
Gold Fields Australasia Pty Ltd
2013

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Government of South Australia
Department for Manufacturing, Innovation, Trade, Resources and Energy

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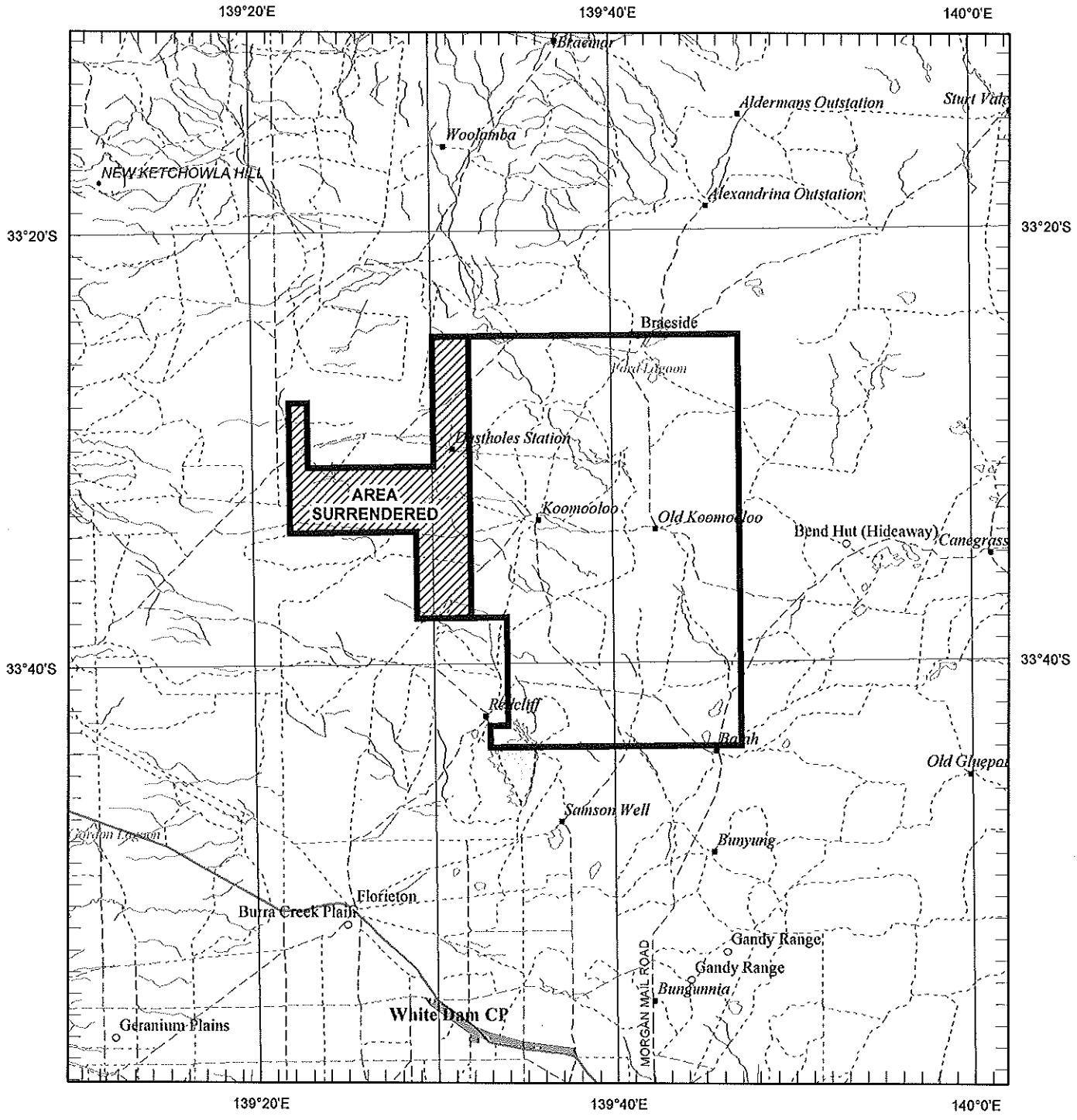
SCHEDULE A



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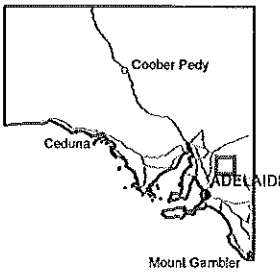
LOCALITY



APPLICANT : **GOLD FIELDS AUSTRALASIA PTY LTD**

FILE REF : **2012/00003** TYPE : **MINERAL ONLY**

AREA : **784** sq km (approx)

1 : 250 000 MAPSHEETS : **BURRA CHOWILLA**

LOCALITY : **KOOMOOLOO AREA -**
Approximately 170 km northeast of Adelaide

DATE GRANTED: **12-Apr-2012** DATE EXPIRED: **11-Apr-2014** EL NO: **5068**

DELAMERIAN PROJECT – SOUTH AUSTRALIA

PARTIAL REDUCTION REPORT

For the period
12 April 2007 to 15 January 2013

FOR
EXPLORATION LICENCE

EL 5068 (Koomooloo)

Owned by

Gold Fields Australasia Pty Ltd
ABN 59 097 624 600

Author : D. Langston
Date : 29/05/2013
Distribution:
PIRSA (1 Digital Copy)
Gold Fields Australasia Pty Ltd (1 Digital Copy)

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File Name:

Appendix 1_MorganGravitySurveyRpt.pdf

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Appendix 3_EL5068_SoilData.csv

SUMMARY

The Delamerian Project comprises ten exploration licences which are owned and operated by Gold Fields Australasia Pty Ltd (Gold Fields). The tenements are located within the Delamerian sub province along the north-western margin of the Cainozoic Murray Basin. The area was targeted as being prospective for orogenic style gold mineralisation hosted within Cambrian sediments buried under the Cainozoic cover.

This position was thought to be in a similar structural setting as the Paterson sub-province that hosts the Telfer Au-Cu deposit (>26Moz deposit).

This report outlines exploration undertaken on the surrendered portion of EL5068 during the period 12th April 2007 to 15th January 2013. Exploration work completed throughout EL5068 has included:

- reprocessing and interpretation of existing open file geophysical (gravity and aeromagnetic) data;
- summary of environmental and cultural heritage factors;
- 232 ground gravity stations;
- 321 ionic leach soil samples;
- 46 air-core drill holes for a total of 3,652m, and;
- ASD analysis of 11 air-core drill holes.

Work completed on the area which GFA wish to relinquish includes; reprocessing of open file geophysics data; review of environmental and cultural heritage considerations, acquisition of 21 soil samples for partial leach analysis and regional gravity survey including the acquisition of 3 gravity stations reading on EL5068.

Key Words:

Gold Fields Australasia/ Delamerian/ Cambrian/ Geophysics/ Air-core/ Diamond drilling/ Gold/ Orogenic gold/ Nackara Arc/ Murray Basin/ Structure/ Swan Reach/

1. INTRODUCTION, HISTORY AND EXPLORATION RATIONALE

The Delamerian Project comprises ten exploration licences which are owned and operated by Gold Fields Australasia Pty Ltd (Gold Fields). The tenements are located within the Delamerian sub province along the north-western margin of the Cainozoic Murray Basin. The area was targeted as being prospective for orogenic-style gold mineralisation hosted within Cambrian sediments buried under the Cainozoic cover.

This position was thought to be in similar structural settings as the Paterson sub-province that host the large Telfer Au-Cu deposit (>26Moz deposit), which is the primary target analogue.

This report outlines exploration undertaken on the surrendered portion of EL5068 during the period 12th April 2007 to 15th January 2013. Exploration work completed throughout EL5068 has included:

- reprocessing and interpretation of existing open file geophysical (gravity and aeromagnetic) data;
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1.1 TENURE

EL5068 - Koomooloo was granted to Gold Fields Australasia Pty Ltd on 12th April 2007 originally covering an area of 946km^2 which has recently been reduced to 784km^2. A tenement location plan is presented in Figure 1.

1.2 LOCATION and ACCESS

EL5068 – Koomooloo is located approximately 170km north-east of Adelaide in the North Eastern Pastoral District of South Australia. The Goyder Highway intersects the tenement with a relatively dense network of roads and unsealed farm tracks providing reasonably good access within the licence areas. The tenement is located on the following Map Sheets:

A relatively dense network of roads and unsealed farm tracks provide reasonably good access within the licence areas. EL5068 is located on the following Map Sheets:

- 1:250,000 Sheet SI 54-05 (Burra) and SI54-06 (Chowilla)
  - Florieton (6730) 1:100K sheet
  - Caroona (6731) 1:100K sheet
  - Koomooloo (6830) 1:100K sheet
  - Murkaby (6831) 1:100K sheet

1.3 PREVIOUS EXPLORATION

The relinquished portion of EL5068 – has been only sporadically explored in the past with previous work focused on uranium, heavy mineral and coal potential within upper Murray Basin sediments and only very limited exploration for gold and base metals in the underlying basement geology.

A summary of relevant or related previous exploration is outlined below:

1.3.1 TARGET - Metalic Minerals:

EN04539	***EL927***	***Aberfoyle Exploration***	***1983***

Exploration has been undertaken for possible economic porphyry style mineralisation in the western flank of the Ordovician Bendigo Granite batholith. Initial work comprised geological mapping, surface sampling, ground magentics, reconnaissance RAB drilling. Evidence of late-stage magmatic intrusions into the local Adelaidean country rock is lacking and later investigation indicated the potential for finding sediment-hosted gold mineralisation in area was low.

ENV06460	***EL1306***	***BHP Billiton Nickel West***	***1985***

Exploring for possible hydrothermal/epithermal gold deposits in the Adelaidean. Work has included reprocessing of aerial magnetic survey data, rock chip sampling, ground magnetic survey and reverse circulation drilling. Drilling did not replicate the significant gold anomalism from rock chip samples taken from a historic working and further work along the Florieton Fault were not followed up.

ENV06460	***EL1416***	***Fairview Gold Pty Ltd***	***1991***

Fairview Gold was targeting gold and base metal deposits within the axial portion of the Nackara Arc and along the fringes of the Bendigo Granite which may provide a heat source for mobilisation and concentration of

metal deposits. Extensive geological traversing and rock chip sampling was completed on the exploration license.

ENV08773	***EL1834***	***Placer Exploration Ltd***	***1994***

Exploration for possible porphyry style or skarn/replacement type copper-gold mineralisation over an area of Delamerian granite batholith. Work program included the acquisition of geophysical data sets (IP, aeromagnetic & ground magnetics), soil and rock chip sampling, plus the resampling of previous drill holes. Results from the work program were disappointing with very low, inconclusive gold results which are probably due to an excessive depth of cover on the granite bedrock.

ENV09255	***EL2119***	***MIM Exploration Pty Ltd***	***1997***

Exploration targeted possible gold, base metal and platinum group elements lying within, or spatially associated with Delamerian ultramafic intrusives occurring over an area of the Kanmantoo Trough. A number of Sirotem traverses were completed and resampling of historic drill holes were conducted, but the elevated Au, Cu, Ni and PGE values were not followed up due to the limited width and excessive depth which they were recorded.

ENV09721	***EL2609***	***Normandy Gold***	***2000***

Exploration for hidden copper-gold mineralising systems possibly genetically related to fractionated, high crustal level emplaced Cambro-Ordovician intrusives. An air-core and diamond drill program was conducted targeted at discrete magnetic highs and possible alteration zones within the vicinity of Delamerian granites. No large alteration or mineralisation systems were indicated.

1.3.2 TARGET – Coal (and base metals and uranium):

ENV03207	***EL373***	***Dampier Mining Co. Ltd***	***1978***

EL373 was primarily pegged to test the western part of the Murray Basin, while also testing the basement for base metal potential. Exploration consisted of rotary drilling, geophysical logging, grid-based ground magnetic survey and petrographic studies. This work failed to indicate any coal or significant base metal potential. Historic drilling was carried out by Dampier Mining within the relinquished area but failed to intersect any significant mineralisation.

ENV03957	***EL1037***	***CRA Exploration***	***1985***

Work targeted both coal and diamond potential of EL1037. Work included detailed aerial surveys, 104 drill holes and analysis of over 1400 geochemical samples. Drilling for coal along the downthrown side of the Morgan Fault intersected thin (<2m) lignite beds within the Eocene Renmark Beds. Drilling of 24 of 107 potential kiberlitic anomalies intersected a variety of magnetic basement rocks including 2 kimberlitic breccias. Further work was discontinued due to excessive thickness of the Tertiary cover.

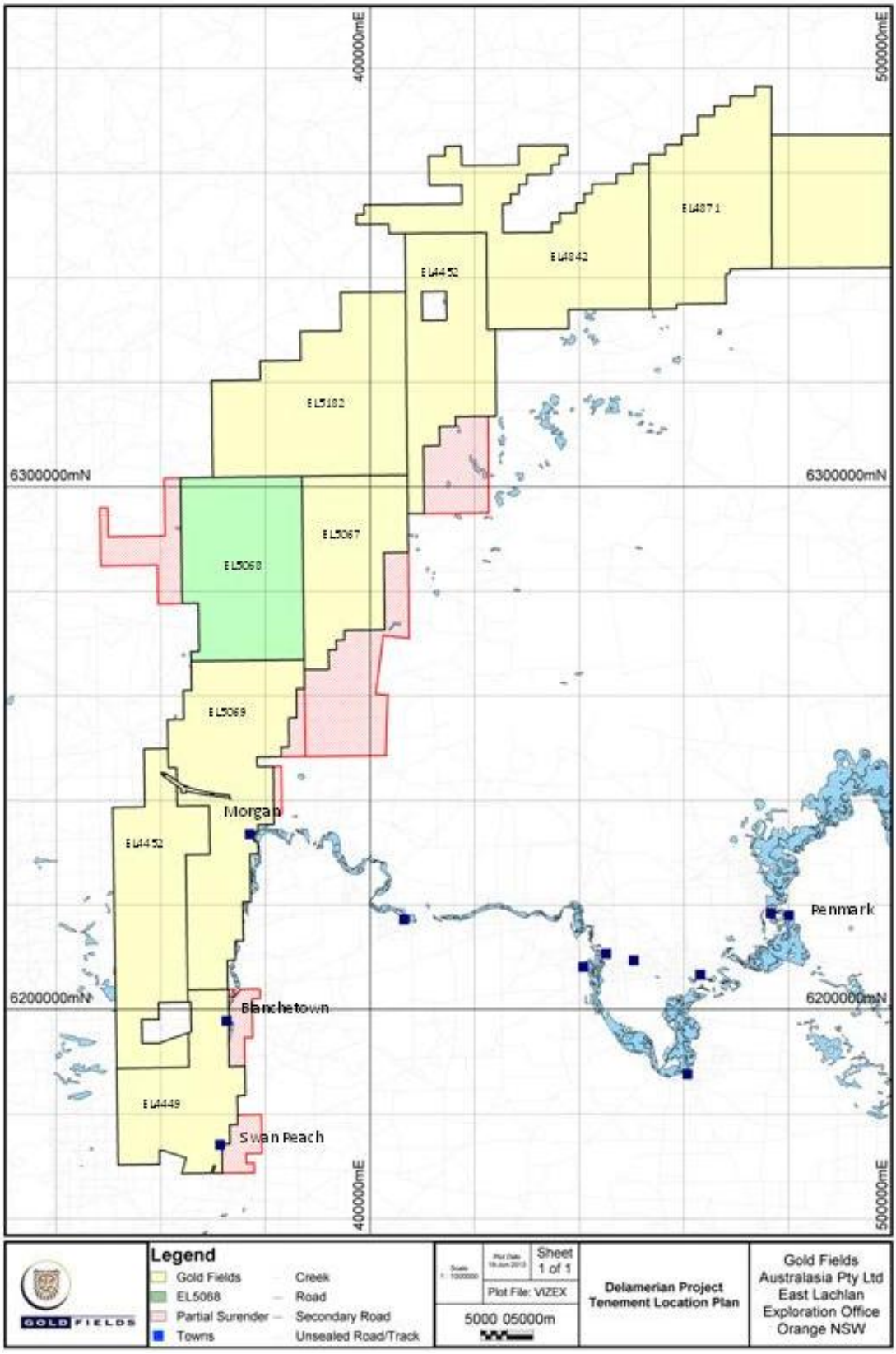

Figure 1: Location of EL5068 within Gold Fields' Delamerian Project.

2. REGIONAL GEOLOGY

EL5068 – Koomooloo is located along the northwestern margin of the Cenozoic Murray Basin. Basin stratigraphy comprises a thin blanket of Quaternary sediments overlying Tertiary fluvial to shallow marine sediments that are flanked to the west and south by Neoproterozoic to Cambrian rocks of the Adelaide Geosyncline and Kanmantoo Group, and to the north by Palaeo and Mesoproterozoic rocks of the Curnamona Craton/Willyama Complex.

Basement geology under the Murray Basin is poorly understood and largely reliant on interpretation of aeromagnetic and gravity geophysical data. The project area basement is interpreted as largely comprising Cambrian Kanmantoo metasediments intercalated with magnetic volcanic and intrusive rocks, and intruded by Cambro-Ordovician felsic intrusive and mafic to intermediate intrusive and extrusive (gabbro, diorite, basalt and dolerite) rocks.

GFA had identified the Delamerian fold and thrust belt sub-province, and in particular the region of maximum flexure (oroclinal bending) through the Nackara Arc region, as being highly prospective for sediment hosted orogenic style gold mineralisation, potentially analogous to Telfer style mineralisation (>26Moz deposit).

Parameters considered important for the formation of large orogenic gold deposits (such as Telfer) that are evident within the Delamerian sub province, include:

- The deep marine host sediments of the Cambrian age Kanmantoo Group which have been inverted, folded and faulted in response to at least one major orogenic event, the Cambro-Ordovician Delamerian Orogeny.

- A second orogenic event, the Ordovician Benambran Orogeny, is also likely to have impacted on the Delamerian sub-province. This second orogenic event is responsible for the vein- hosted orogenic gold deposits in the Bendigo Zone of central Victoria (approximately 50Moz of gold production to date).

- The Delamerian sub-province or Fold Belt takes the form of an oroclinal bend in response to cratonic buttressing from the Archaean to Proterozoic Gawler and Curnamona Cratons located to the west and north. This oroclinal bending is thought to focus deformation and thus potential gold bearing orogenic fluids towards the axis of the bend.

- Other important parameters include: major cratonic margin mantle tapping structures, open folding of the thick reduced sequence of back-arc basin turbidites (the Kanmantoo Group), sub-marine lavas and intrusives, greenschist facies metamorphism, major orocline subparallel fault structures, long lived intersecting large scale lineaments or cross-orogen structures and the potential for syn to post-orogenic granitoid intrusions.

3. GOLD FIELDS EXPLORATION

2007/2008 EXPLORATION

Exploration undertaken by Gold Fields during the reporting period within the area of reduction has comprised the following:

- Reprocessing and interpretation of existing open file geophysical (gravity and aeromagnetic) data;
- Review of environmental considerations; and
- Land access negotiations.

Reprocessing of open file aeromagnetic data covering the area of interest was acquired from PIRSA as gridded data. Data sets relating to the region of interest are listed in Table 1.

Table 1 : Public Domain Aeromagnetic Data Sets

Survey Name	Company/Flown For	Line Spacing & Direction	Year
Kia Ora	Dampier Mining Co.	250 EW	
*Florieton 80 SA11	CRA Exploration	300 EW	1980
SAEIB3	PIRSA	400 EW	1978
Chowilla	SADME/BMR	1600 EW	
Burra- Whyalla	SADME/BMR	1600 EW	

2008/2009 EXPLORATION

Exploration undertaken by Gold Fields during the reporting period within the area of reduction has comprised the following:

- Gravity Survey Sampling.

Gold Fields Australasia contracted Daishsat Geodetic Survey on Exploration Licences 3735 (now EL5067), 3736 (EL5068), 3737 (EL5069), 3970, 3627 (EL4425). A total of 773 station readings were taken between the 29th of January and the 20th of February 2009 which covered an area of approximately 3300km^2. Data were used principally to try to predict depth of cover, with mixed success owing to similar densities of clays in the Murray Basin sediment stratigraphy and the oxide profile of weathered basement metasediments. Gravity collected and processed in the area Gold Fields wish to relinquish can be seen in Figure 2. A total of 3 gravity station readings were recorded in the area of reduction.

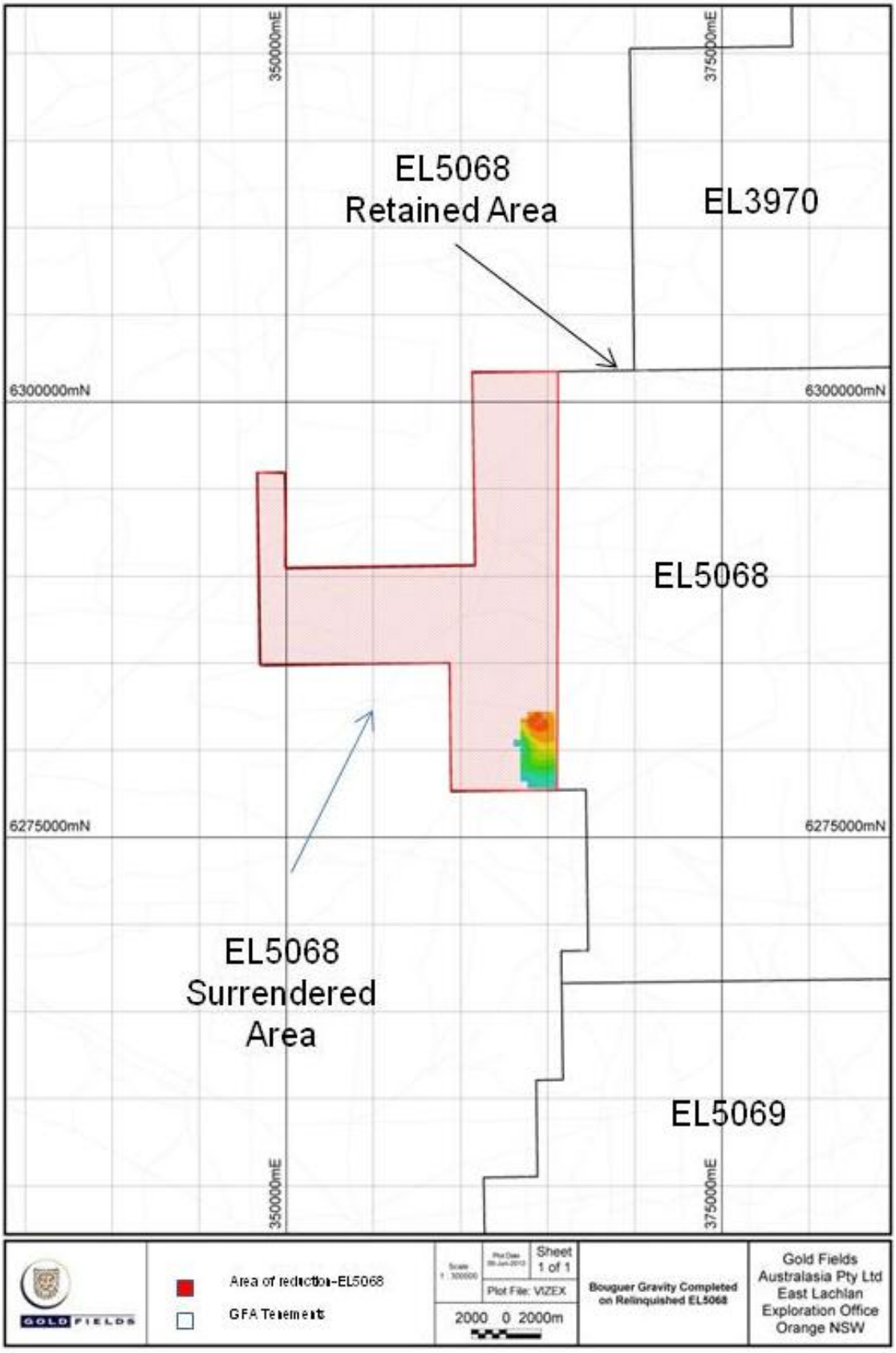

Figure 2: Bouger Gravity completed over the relinquished area of EL5068.

2009/2010 EXPLORATION

A 1km spaced -5mm bulk soil survey was completed over EL5068 and adjoining exploration licence EL3970, using existing roads and tracks. Samples were submitted for to ALS Chemex for 'Ionic Leach' as well as aqua regia digest (Me-MS41 scheme) analyses. A total of 21 samples were completed on the area GFA wish to relinquish, location of these samples can be seen in Figure 3.

Figure 3: Ionic leach soil sample locations.

2010/2013 EXPLORATION

No work was completed in this period.

4. ENVIRONMENT AND LAND USE

A review of land use tenure type and environmental issues associated with the Delamerian Project was compiled to assist in preparation of an Environmental Legal Obligations Register for the Delamerian Project. The aim was to highlight areas of environmental (and other) sensitivity and restricted lands that occur within and on the margins of the project area.

A summary of Aboriginal and Environmental Heritage factors identified within the project tenements is documented in Table 2. A land use tenure type and environmental and cultural heritage sensitivity plan is presented as Figure 3.

5. SUMMARY OF WORK COMPLETED

Work completed on the area of relinquishment within EL5068 consisted of:

- Reprocessing and interpretation of existing open file geophysical (gravity and aeromagnetic) data;
- Review of environmental & heritage factors; and
- Regional gravity survey with 3 survey stations recorded;
- Regional 'Ionic Leach' soil survey with 21 samples taken in the area of reduction.

6. CONCLUSIONS

The area surrendered is considered to have low exploration potential for gold mineralisation due to the thickness of the overlying Murray Basin cover.

Table 2: EL4449 – Summary of Identified Aboriginal and Environmental Heritage Factors

Tenement	Holder	PIRSA/DWLBC	Aboriginal Heritage	Department of Environment & Heritage	Natural Resource Management Services	Significant Species - Flora	Significant Species - Fauna	Common Name	SA Status	Aust Status
EL5068	GFA	Potential for two aquifer systems identified - deeper aquifers are confined and may be artesian. * GFA required to contact DWLBC Drilling Inspector 7 days prior to drilling and 24 hrs prior to any cementing operations. * In event of artesian conditions a DWLBC Drilling Inspector must be notified immediately on (08) 8463 6872 or mb. 0428 828 569. * Holes must be abandoned in accordance with general specifications (Info Sheet G11).	No Aboriginal Sites.	Salt and clay pans/ drainage channels.		Austrodanthonai Tenuior Maeriana rohriachii	 Acanthiza iredalei Nichtophilus timoriensis	Short-awn Wallaby-grass Rohriach's Bluebush Slender-billed Thornbill Greater Long-eared Bat	R R V V	 V V

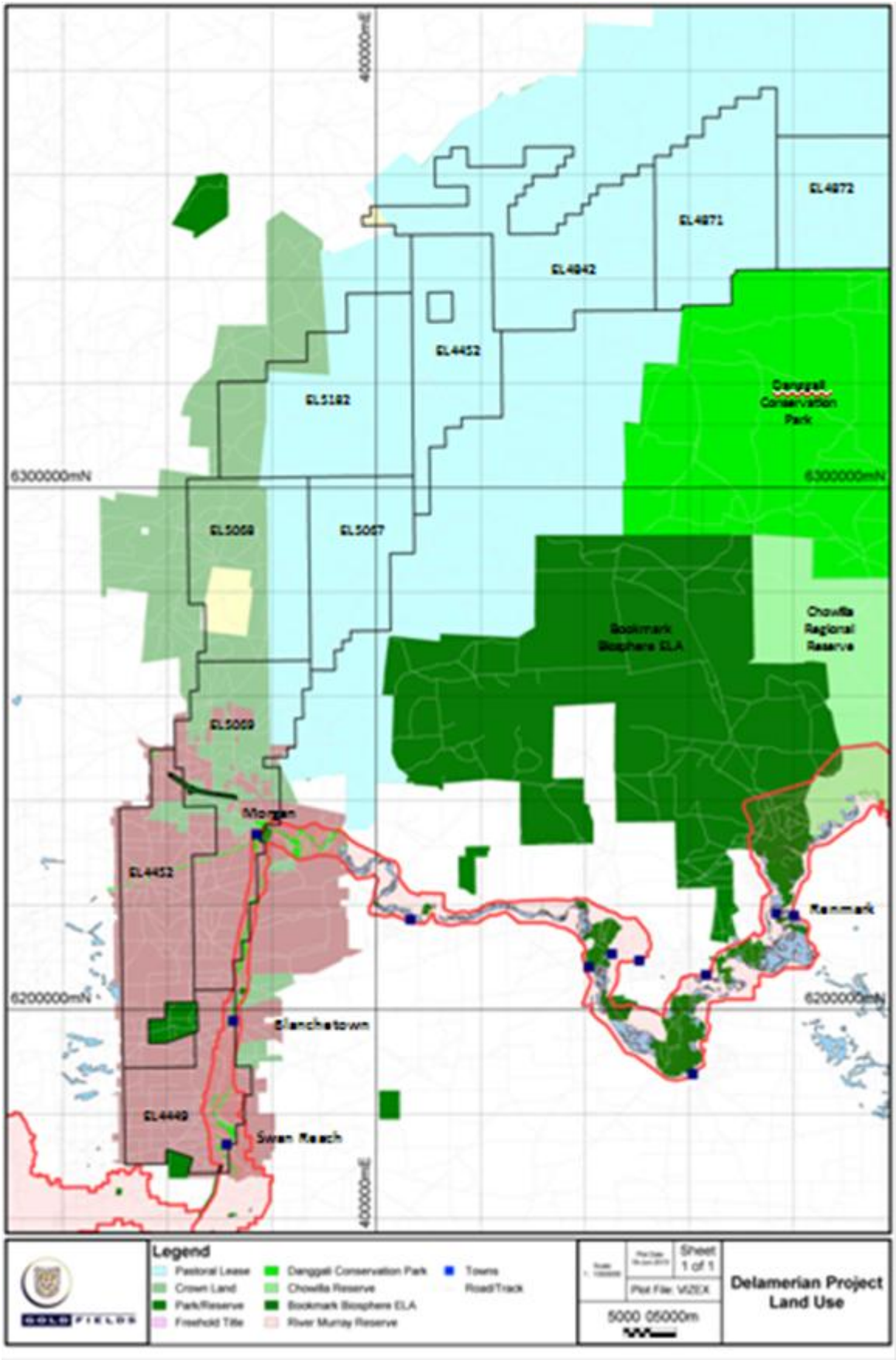

Figure 4: Land use, tenure type and environmental and cultural heritage sensitivity plan.

GOLDFIELDS EXPLORATION
MORGAN GRAVITY SURVEY
February 2009

Report Number 09002
A. McCarthy

CLIENT

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1. INTRODUCTION

A precision GPS-Gravity survey was carried out by Daishsat Geodetic Surveyors between 29th of January and the 20th of February 2009 on behalf of GOLDFIELDS Explorations Inc. A total of 773 stations were surveyed to the west and northwest of the township of Morgan in South Australia.

Gravity data was acquired using Scintrex CG-5 and LaCoste & Romberg type G gravity meters. Position and level data were obtained using Leica SR530 and GX1230 geodetic grade GPS systems. All receivers were operating in post-processed kinematic mode. Data was acquired using a combination of Daishsat Vehicle-borne and Rhino Borne survey methods.

Gravity data were reduced using standard reductions on the ISOGAL84 gravity network. Post processed GPS data was exported as MGA coordinates with levels expressed as metres above the Australian Height Datum.

2. SURVEY OVERVIEW

The Goldfields Morgan gravity survey covered an area of approximately 3300 km^2 in the central eastern area of South Australia. The survey area was a south westerly extension of a prior survey conducted by Daishsat on behalf of Goldfields in early 2006.

The terrain and vegetation encountered across the survey was typical of the area ranging from open grazing country through to dense areas mallee and black oak

The location of the survey is shown in Figure 1. Appendix A contains a plot of the final station locations and Appendix C contains the specifications for the survey.

Photo 1: Typical terrain and vegetation in the survey area.






Photos 2- 7: Typical terrain and vegetation in the survey area.

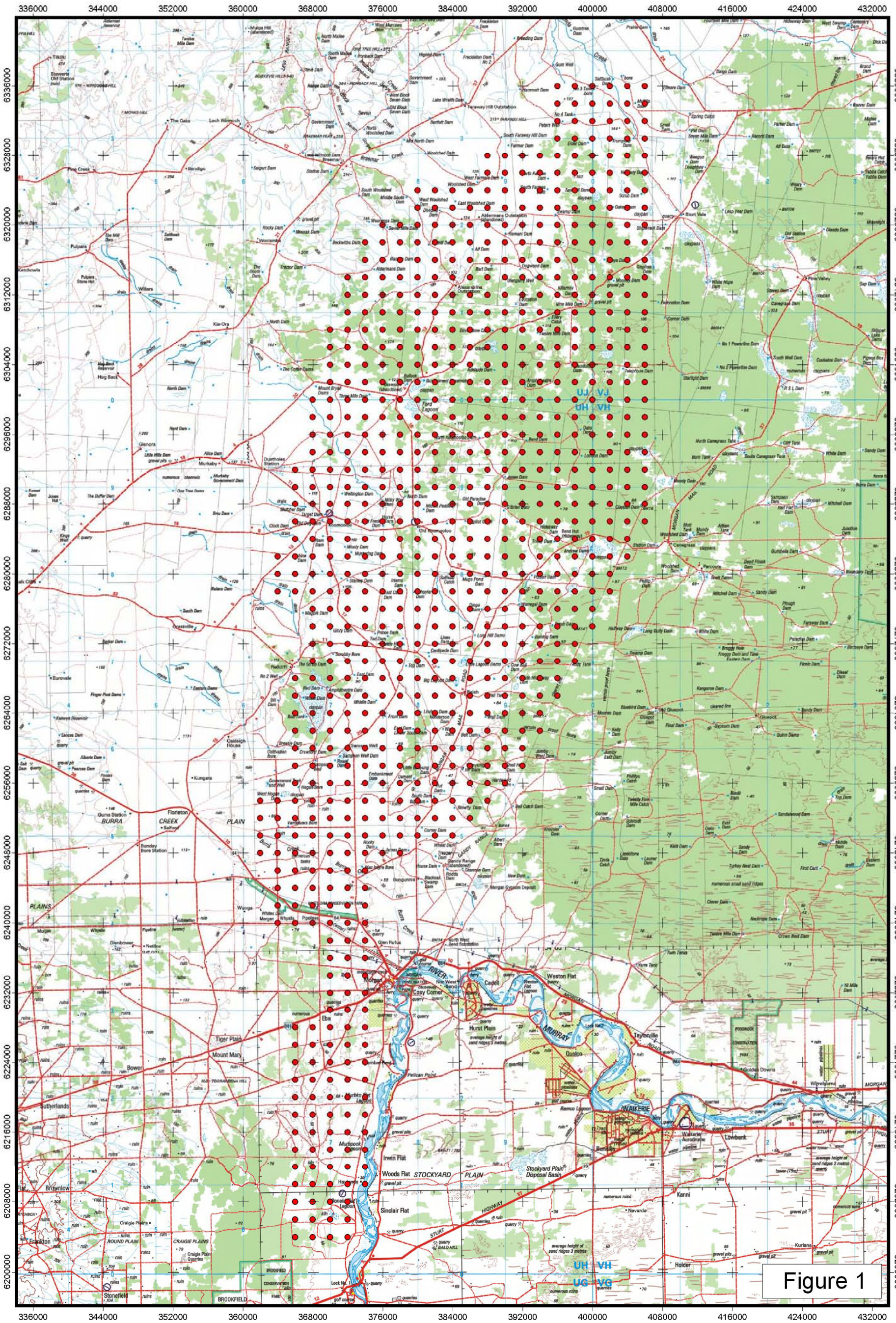
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Figure 1

3. PERSONNEL AND EQUIPMENT

3.1 Personnel

The supervisor in charge of the project was Andrew McCarthy. Andrew was responsible for daily management of the job and for nightly data processing to ensure quality and integrity. Gravity and GPS measurements were carried out by:

Jon Nankaville
Matt Ingal

Final data reduction, inspection and reporting were performed by the company Geophysicist, Grant Coopes.

3.2 Survey equipment

The following survey equipment was utilised on the gravity survey:

- Scintrex CG-5 digital gravity meters (P & Q meters)
- LaCoste & Romberg Gravity Meter (L & M meter)
- Leica 1200 dual frequency GPS receivers
- Leica SR500 dual frequency GPS receivers
- Notebook computers for data processing and backup
- Garmin Handheld GPS receivers for vehicle navigation
- Various chargers, solar cells and batteries

3.3 Vehicles

Due to the type of terrain and remote locations, 4WD Landcruisers were utilized as support vehicles for the surveys. To maintain the high Daishsat safety record, vehicles were fitted with a range of safety equipment including:

- One 20l jerry can of water
- Dual fuel tanks
- Two spare tyres
- UHF radio and satellite phone with car kit
- Self-recovery equipment including winches, snatch straps chains etc.
- Tyre pliers to effect tyre repairs in the field
- Tools and spares to enable field repairs as necessary
- Survival kits with EPIRB emergency locator beacons
- Trans track satellite vehicle monitoring and reporting systems

3.4 Survey Vehicles

Landcruiser 4x4 Utes

Due to the scale and accessibility of the stations within the survey area the most efficient method of transport between stations was by four wheel drive vehicle. Daishsat utilizes Toyota Landcruiser utes for their simplicity, ruggedness and reliability.

Photo 8: Yamaha Rhinos

Yamaha Rhino

For the more remote and less accessible areas of the survey grid Yamaha Rhinos were used as an alternative to the Landcruiser due to their ability to operate in tighter and more densely vegetated areas. The Rhinos were utilized in areas with limited road or track access where the use of larger 4x4 vehicles may have resulted in damage to the environment and the vehicles themselves. Rhinos are a derivative of a Quad Bike designed with greater stability and user safety in mind while maintaining the tough go almost anywhere ability of the 4X4 Quad Bike

3.5 Accommodation

The crews were accommodated as close as practical to the survey areas with accommodation and meals provided by the Morgan Hotel.

3.6 Communications

The survey crew and support vehicles were equipped with hand-held Iridium satellite phones as well as UHF and VHF transceivers. “Omnitrack” satellite based tracking was used on all vehicles to enable asset monitoring via a web interface.

Scheduled communications were made between the crews at set intervals along with ongoing monitoring and communication with the Perth and Murray Bridge offices.

Photo 9: Landcruiser Ute with leica 500 GPS base in foreground

4. GPS SURVEYING AND PROCESSING

4.1 Set out of the grid

This was done concurrently with the gravity data acquisition using navigation grade receivers operating in autonomous mode. Where possible, the readings were taken as close to the ideal coordinates as possible. As the receivers were operating in autonomous mode, set out accuracy was usually better than 10m.

Raw kinematic GPS data was logged by dual-frequency Leica GX1230 receivers installed inside the survey vehicles. Static GPS data was logged at the base station using two Leica System SR530 GPS receivers for later post-processing.

Repeat stations were placed throughout the surveys to monitor any variations in positional accuracy. Repeats are placed with a washer tied with flagging and marked with the station number was used for future identification. At each station, the station number, position and RL were recorded digitally by the crew.

4.2 Survey datum and control

The gravity surveying, and hence any gravity reductions, used the Australian Height Datum (AHD) as the reference datum. New GPS/Gravity base stations were established at each of the three bases using three days worth of static data and connections to ITRF stations using Geoscience Australia's online GPS processing system, AUSPOS. For more information on this system, please visit the Geoscience Australia website at http://www.ga.gov.au/geodesy/sgc/wwwgps/. Final deviations of better than 5mm were obtained for x, y and z, for all occupations. Appendix D contains the GPS base station information.

Photo 10: Local wildlife encountered during the survey.

4.3 Processing of the position and level data

The raw GPS data was recorded onto the internal RAM of the GPS receivers. The data was downloaded nightly onto a laptop computer for post-processing using Waypoint's premier processing software package – Grafnav V7.80. Waypoint combines the processing components, GrafNav and GrafNet, in a complete package.

GrafNav processes data for one baseline (e.g. one base and one remote). GrafNav is normally used for kinematic data which it is extremely well suited for. It can also process single static baselines. Receiver types can be mixed and matched via the use of a common format. This component of Waypoint was used for processing the kinematic data acquired each day.

GrafNav and GrafNet share the same processing engine that has been under continuous development since its original inception by Waypoint in 1992. The core of this robust engine is its carrier phase kinematic (CPK) Kalman filter. Some of the major advantages of Waypoint's kernel are:

Fast processing - The GrafNav kernel is one of the fastest on the market. It will process ~0.8 epochs per MHz per second on a Pentium II.

Robust Kalman filter - From experience with processing GPS data from fast jets and NASA sounding rockets, the processing kernel has become extremely robust. Efforts have been made to account for all of the various data error possibilities given the different types of GPS receivers that GrafNav/GrafNet can handle.

Reliable OTF - Waypoint's on-the-fly (OTF) algorithm, called Kinematic Ambiguity Resolution (KAR), has had years of development and stresses reliability. Variations are implemented for both single and dual frequencies, and numerous options are available to control this powerful feature

Accurate Static Processing - Three modes of static processing are implemented in the processing kernel. Fixed static is the most accurate. A quick static solution is also available as an alternative, while the float and iono-free float solution is useful for long baselines.

Dual Frequency - Full dual frequency support comes with GrafNav/GrafNet. For ambiguity resolution, this entails wide/narrow lane solutions for KAR, fixed static and quick static. Ionospheric processing is very important with the peak of the ionosphere's cycle occurring in 2000. The GrafNav kernel implements two ionospheric processing modes including the iono-free and relative models. The relative model is especially useful for airborne applications where initialization is near the base station, and this method is much less susceptible to L2 phase cycle slips.

Forward and Reverse - Processing can be performed in both the forward and reverse directions. Both GrafNav and GrafNet also have the ability to combine these two solutions to obtain a globally optimum one.

Velocity Determination - Since the GrafNav kernel includes the L1 Doppler measurement in its Kalman filter, velocity determination is very accurate. In addition to this, a considerable about of code has been added specifically for the detection and removal of Doppler errors.
Long Baseline - Because precise ephemeris and dual frequency processing is supported; long baselines accuracies can be as good as 0.1 PPM.

For more information about Waypoint processing software, and in particular, GrafNav, please visit the Waypoint http://www.waypnt.com/grafnav_d.html.

Simple transformations to MGA and AHD were done using the GPS derived WGS84 positions.

MGA94 coordinates were obtained by simply projecting the GPS-derived WGS84 coordinates using a UTM projection with zone 54S. For all practicable purposes, the WGS84 geodetic coordinates are equivalent to GDA94 geodetic coordinates, so no transformation is necessary. For more information about GDA94 and MGA94, please visit http://www.ga.gov.au/geodesy/datums/gda.jsp.

AHD heights were calculated via Waypoint software using the latest geoid model for Australia, AUSGEOID98. Information about the geoid and the modeling process used to extract separations (N values) can be found at http://www.ga.gov.au/geodesy/ausgeoid/. To obtain AHD heights, the modeled N value is subtracted from the GPS derived WGS84 ellipsoidal height (Figure 2).

$$H_{AHD}=h_{WGS84}-N$$

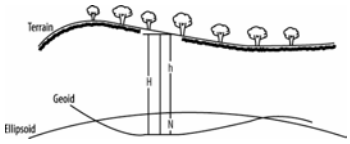


Figure: 2: Geoid-Ellipsoid separation

4.4 GPS Performance

Performance from the Leica 1230 receivers was excellent. There were no stations that required repeating due to GPS failure or poor coordinate quality.

Photo 11: Post process GPS base setup north of Morgan

5. GRAVITY SURVEYING AND PROCESSING

5.1 Gravity data acquisition

Gravity observations were made concurrently with the GPS measurements. Two observations were made for each station, with each observation consisting of a 20-second or greater stacking time. Multiple observations were made at each station so that any seismic or instrumental noise could be immediately detected. The tolerance between readings was set at 0.05 of a dial reading (0.05 mGals). Vertical and horizontal levels were restricted to 5 arc seconds at all times. At each station, the station number, time and two gravity readings (in dial units) were recorded in DAISHSAT carbon-copy gravity field books. The Scintrex meters also automatically record the station, time and readings digitally to allow for downloading to computer.

5.2 Gravity base stations

Gravity base stations were used for calculation of absolute gravity and drift determination. Details of the gravity bases are contained in Appendix D. When in the field, base station readings were taken in the morning before the first observation and at evening after the last observation. When taking a base station reading, the observed gravity values were stacked over 60 seconds to ensure accuracy. Observations were repeated until the readings repeated to 0.010 of a dial reading or less.

Two new base stations were established during the survey process, the first 14km north of Morgan on the roadside and the second at the “Braeside Ruins” The observed gravity values for the base stations were calculated through completing multiple B-A-B gravity loops to AFGN stations located at the Waikerie Airport Terminal Building. The expected accuracy of the tie control surveys is better than 0.01 mGals.

5.3 Gravity data processing

Raw gravity data were processed on a daily basis to check for quality and integrity. This interim process produced a set of Bouguer Anomaly values which were contoured and imaged to provide a check for any anomalous readings that would need repeating. Geosoft GRAVRED software was used for the gravity reduction in the field. Other software used on this project includes Arcview, ChrisDBF, Waypoint and Oasis Montaj. The formulae used for final processing are listed below:

Instrument scale factor: This correction was used to correct a gravity reading (in dial units) to a relative gravity unit value based on the meter calibration.

Tidal correction: This correction was used to correct for background variations due to changes in the relative position of the moon and sun. The Scintrex calculated ETC was removed and a new ETC calculated using Geosoft Formulae and the surveyed GPS latitude. The formulae used are too complex to list here.

Instrument Drift: Since gravity meters are mechanical, they are prone to drift (extension of the spring with heat, obeying Hooke’s law). If two base readings are taken one can assume that the drift between the two readings is linear and can therefore be calculated. The drift and tidal corrected value is referred to as the *observed gravity*.

Normal Gravity: The theoretical value of gravity was calculated using the 1967 variant of the International Gravity Formula and used to latitude correct the observed gravity.

$$Gn=9,780,318.456*(1+0.005\ 278\ 895*\sin^2\phi+0.000\ 023\ 462*\sin^4\phi)$$

where ϕ represents degrees of latitude;

Free-Air Correction: Since gravity varies inversely with the square of distance, it is necessary to correct for changes in elevation between stations to reduce field readings to a datum surface (in this case, AHD).

$(3.08768 – 0.00440\ \sin^2\phi)*h – 0.000001442*h^2\ \mu ms^{-2}$ per metre

Bouguer Correction: This correction accounts for the attraction of material between the station and datum plane that is ignored in the free-air calculation. A value of 2.67 tm^3 was used in the correction.

$0.4191*\rho\ \mu ms^{-2}$ per metre

where ρ = density 2.67 tm^3

Free Air Anomaly: This is obtained by applying the free air correction (FAC) to the observed gravity reading.

$$FAA=G_{OBSG84}-Gn+FAC$$

Bouguer Anomaly: This is obtained when all the preceding reductions or corrections have been applied to the observed gravity reading.

$$BA267=G_{OBSG84}-Gn+FAC-BC$$

5.4 Gravity meter calibration and scale factors

The gravity meters used had previously been calibrated over a number of calibration ranges in WA and SA. A derived scale factor from these calibrations is shown below:

Meter	Serial No.	Scale Factor
(Q)	40417	0.999795
(P)	40394	1.000614
(L)	G711	1.017640
(M)	G 80	1.04289

6. RESULTS

Raw and processed GPS and gravity data are contained on CDROM as Appendix E. Hardcopy plots of station location and coloured images are contained in Appendix A.

6.1 Stations Surveyed and Survey Progress

In total 945 stations were acquired across the survey area. Of these stations at total of 172 were revisited to ensure data accuracy and quality.

A brief production summary for the survey is show in Table 1 below.

Generally, production was good with the crews averaging over 40 stations per day. This was down a little on original estimates due to a combination of limited access, dense vegetation, overgrown trails and time lost to landholder consultation.

There was no downtime due to geophysical or GPS equipment failure.

Morgan Gravity Survey 2009		
Gravity stations acquired (including repeats)	**945**	stations
Gravity station repeats	**172**	22%
New gravity stations acquired	**773**	stations
Total accidents	**0**	accidents
Total hours lost from accidents	**0**	hours

Table 1: Gravity Production Summary

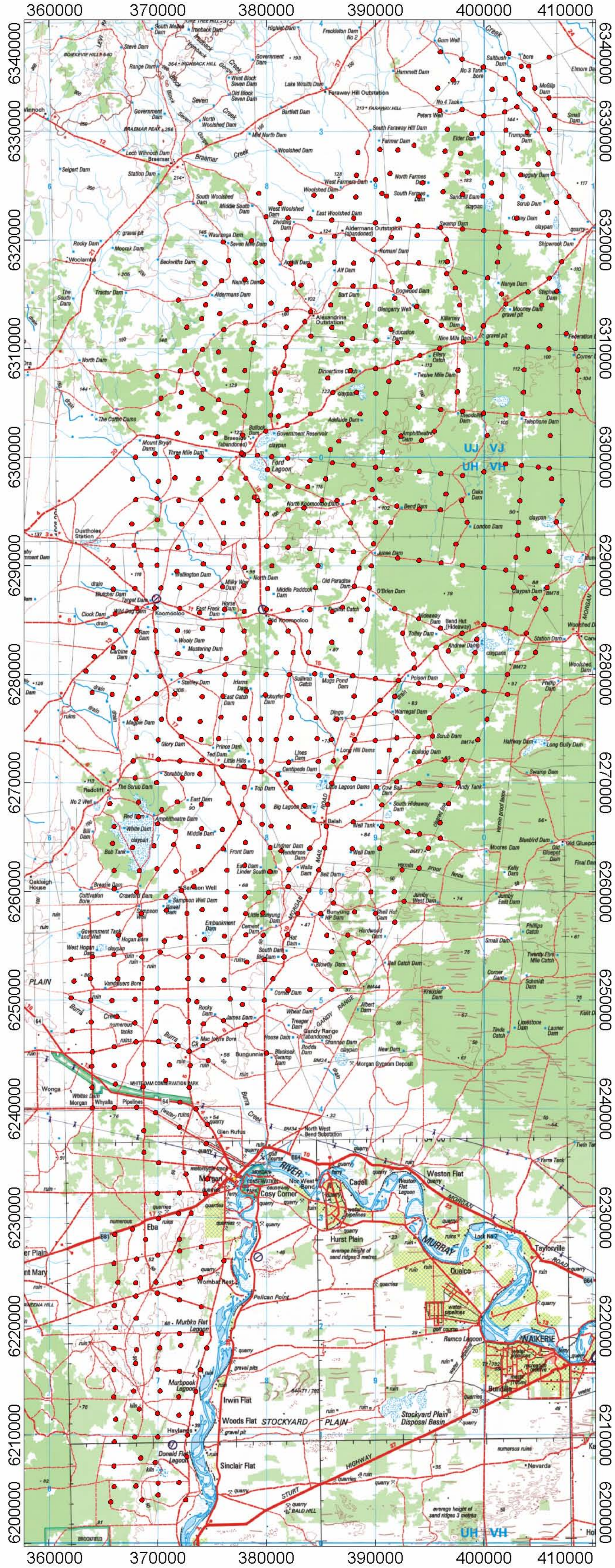
6.2 Data Repeatability

Analysis of the repeat data shows that measurement repeatability is very good for both GPS and gravity observations. Appendix B contains histograms and summary statistics from the analysis. Based on the repeat data, one can assume the following typical accuracies for the observables:

Z position observation: < 0.0467m
Gravity observation: < 0.0226mGals

APPENDIX A

Plots of station location / Images



Scale 1:426632

5000 0 5000 10000 15000

(meters)

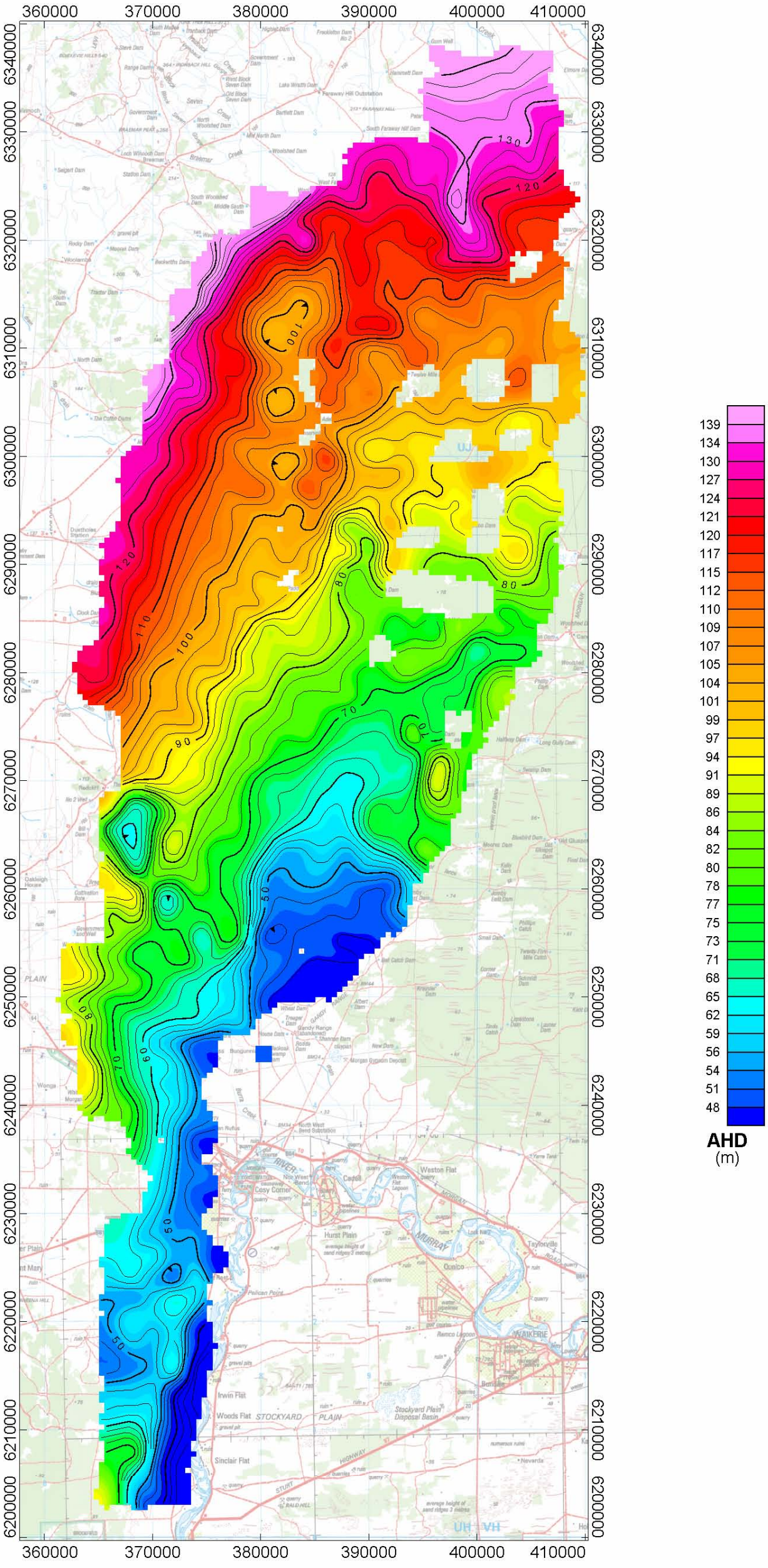
GDA94 / Map Grid of Australia zone 54

09002 GOLD FIELDS EXPLORATION

Morgan S.A. Gravity Survey
Plot of Gained Stations

Survey By Daishsat Geodetic Surveyors
Febuary 2009
www.daishsat.com

Drawn By: A. McCarthy

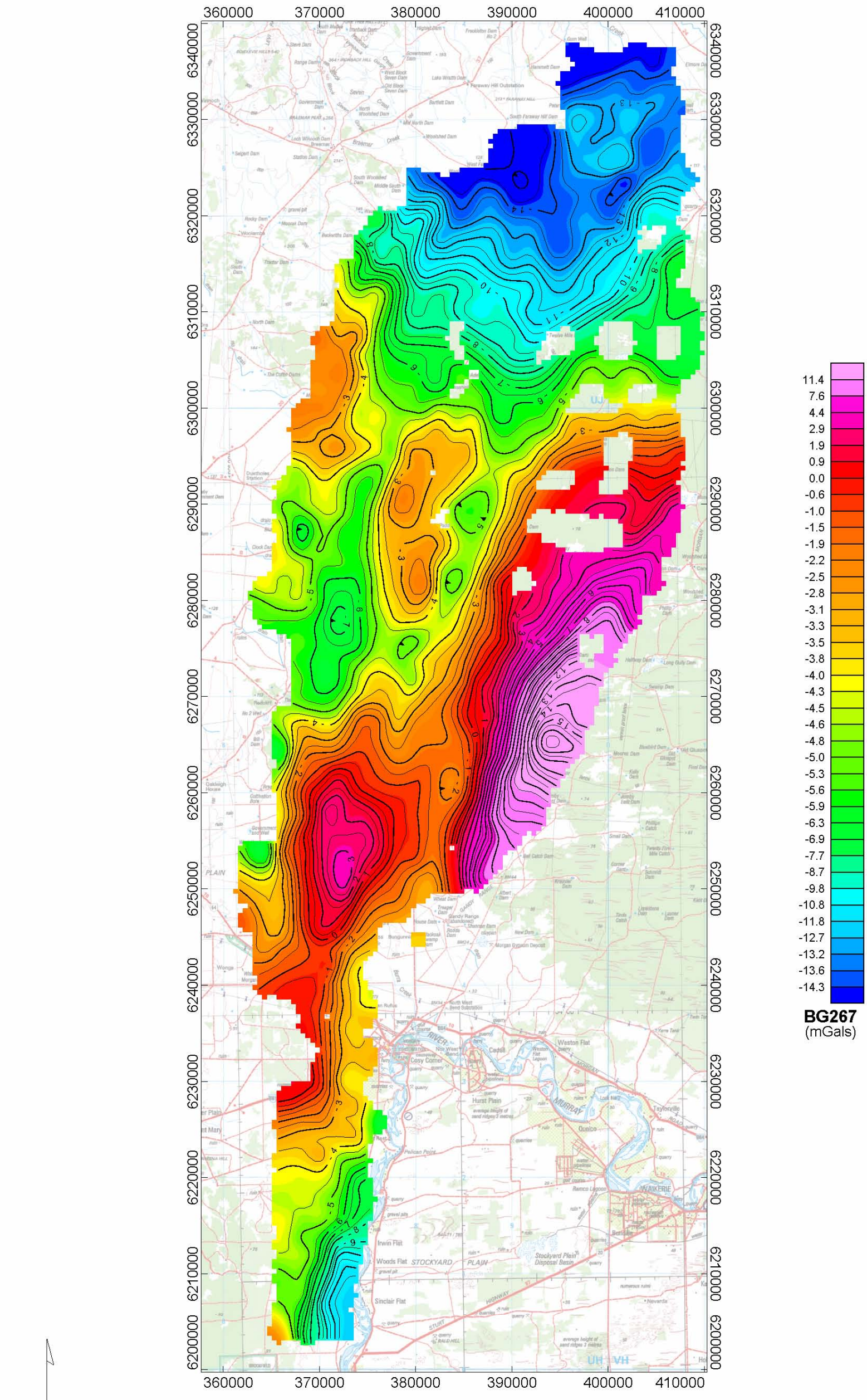


09002 GOLDFIELDS EXPLORATION

Morgan S.A. Gravity Survey
Image of GPS Derived Station Elevation
Histogram Equalisation, Contour Interval 2.5m

Cell Size 500m, Search Radius 3500m
Survey By Daishsat Geodetic Surveyors
Febuary 2009
www.daishsat.com

Drawn By: A. McCarthy



Scale 1:426632

5000 0 5000 10000 15000

(meters)

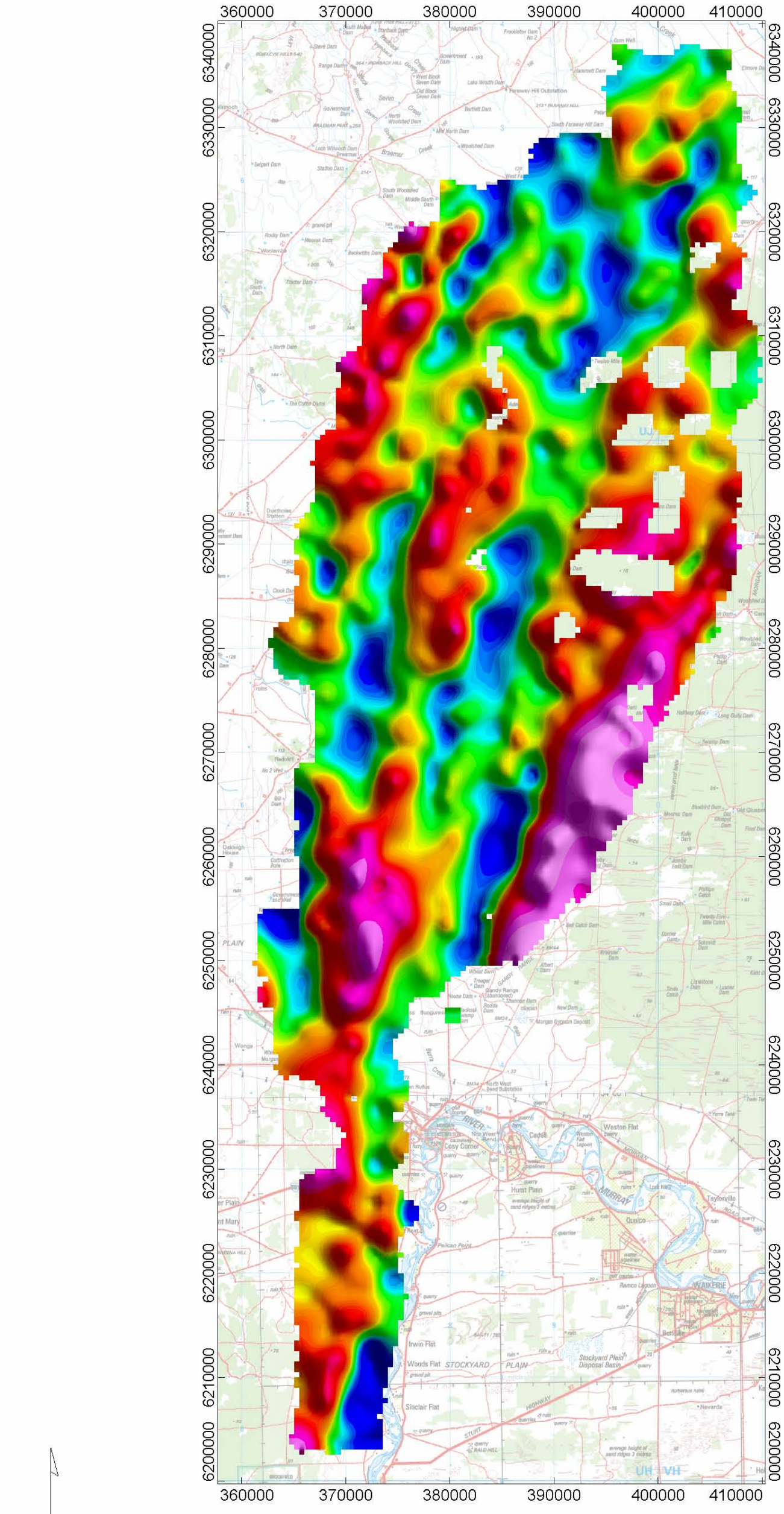
GDA94 / Map Grid of Australia zone 54

09002 GOLDFIELDS EXPLORATION

Morgan S.A. Gravity Survey
Image of Bouguer Gravity 2.67 gm/cc
Histogram Equalisation, Contour Interval 0.5mGals

Cell Size 500m, Search Radius 3500m
Survey By Daishsat Geodetic Surveyors
Febuary 2009
www.daishsat.com

Drawn By: A. McCarthy



Scale 1:426632

5000 0 5000 10000 15000

(meters)

GDA94 / Map Grid of Australia zone 54

09002 GOLD FIELDS EXPLORATION

Morgan S.A. Gravity Survey
Image of 1VD of Bouguer Gravity
Histogram Equalisation, NE Sunshading

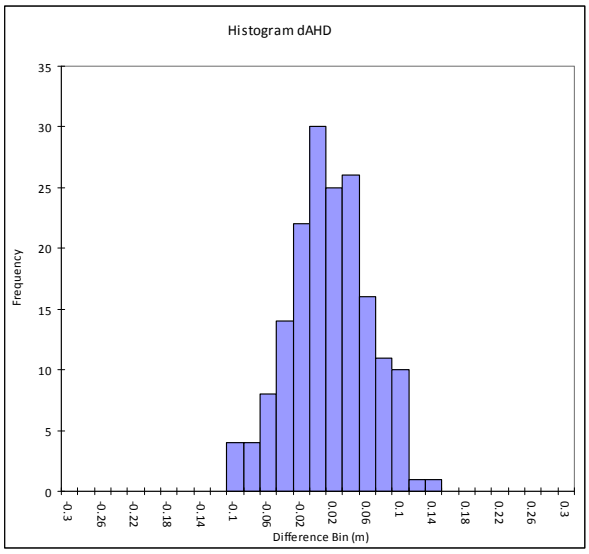
Cell Size 500m, Search Radius 3500m
Survey By Daishsat Geodetic Surveyors
Febuary 2009
www.daishsat.com

Drawn By: A. McCarthy

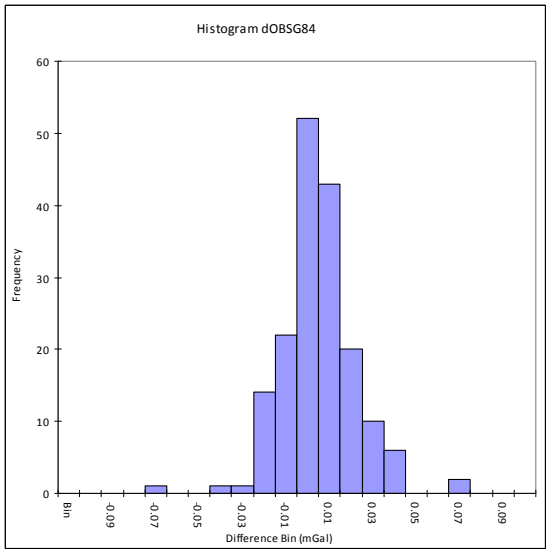
APPENDIX B

Repeat Tabulation and Analysis

Histogram dAHD



Histogram dOBSG84



Summary Statistics

Summary Table	*dAHD*	*dOBSG*
Mean	0.004	0.001
Standard Error	0.004	0.001
Median	0.003	0.000
Mode	0.025	0.001
Standard Deviation	0.049	0.017
Sample Variance	0.002	0.000
Kurtosis	-0.109	3.277
Skewness	-0.009	0.173
Range	0.247	0.137
Minimum	-0.117	-0.075
Maximum	0.130	0.062
Sum	0.768	0.132
Count	**172**	**172**

APPENDIX C

Survey Specifications

Client	GOLD FIELDS Exploration
Survey Name	Morgan
Operators	JN & MI
Techniques Employed	GPS, Gravity
Station Spacing	2000m
Line Spacing	2000m
Gravity Meter	Scintrex CG-5 (P & Q meters), LaCoste & Romberg type G (L & M meters)
GPS	Leica 500 Bases, Leica 1230 Rovers
Number of Points Surveyed	945
Gravity Base	Daishsat Base 0463 & 0464
Date of Survey	29th January – 19th February 2009

APPENDIX D

Base Station Information

GPS Gravity Base 0463 Morgan Roadside

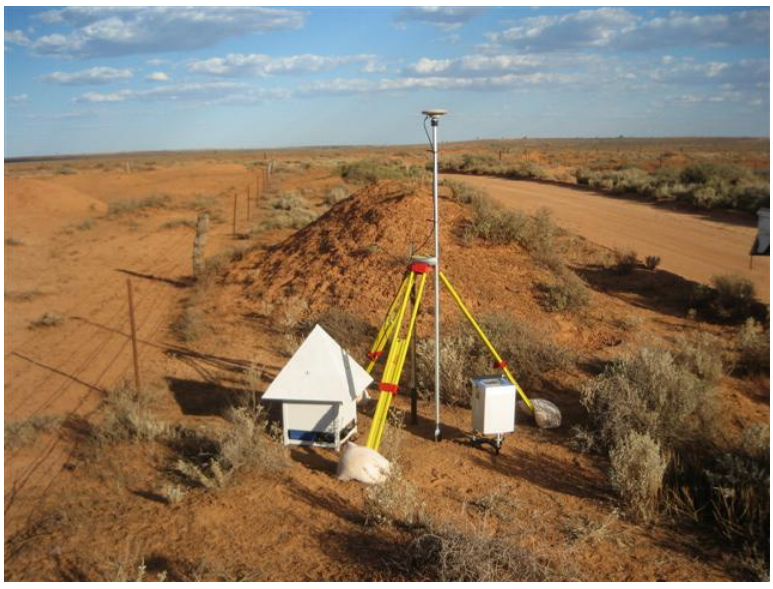
MGA94		GDA94	
EASTING (m)	372886.064	LATITUDE (DMS)	33^0 55' 29.62041" S
NORTHING (m)	6245320.031	LONGITUDE (DMS)	139^0 37' 29.24505" E
ZONE (UTM)	54	Ellipsoidal HT (m)	52.509
HEIGHT (AHD, m)	47.969	N (AUSGEOID98, m)	4.54

OBSERVED GRAVITY	SURVEYED BY
979 631.226 **mGals**	GPS - Daishsat using a multiple static sessions and the AUSPOS online GPS Processing system. Expected accuracy of station coordinates better than 0.005m. Gravity – Daishsat using one SCINTREX digital Gravity Meter and two LaCoste & Romburg Gravity Meters conducting 2X B-A-B loops to the AFGN station located at Waikerie Airfield. The expected accuracy of the Gravity ties better then 0.01 mGals.

MISCELLANEOUS DETAILS

Daishsat base 463 is located on a fence line 14km to the north of the township of Morgan in South Australia.

Access to the base is by vehicle, starting the odometer 0.0km at the car ferry on the western bank of the Murray River in the town of Morgan. Driving to the north west, turn right at 0.6km, down the Morgan to Burra rd. At 1.3km turn left down the Crystal Brook rd continuing to 9.0km before turning right heading north until 14.1km. After turning left base 463 is located at 14.2km three meters to the north of the track against the boundary fence.



Base 463 and distinguishing features

GPS Gravity Base 0464 Braeside Ruins

MGA94		GDA94	
EASTING (m)	377716.179	LATITUDE (DMS)	33^0 25' 42.55815" S
NORTHING (m)	6300373.492	LONGITUDE (DMS)	139^0 37' 57.61725" E
ZONE (UTM)	54	Ellipsoidal HT (m)	110.300
HEIGHT (AHD, m)	104.086	N (AUSGEOID98, m)	6.214

OBSERVED GRAVITY	SURVEYED BY
979575.4908 **mGals**	GPS - Daishsat using a multiple static sessions and the AUSPOS online GPS Processing system. Expected accuracy of station coordinates better than 0.005m. Gravity – Daishsat using one SCINTREX digital Gravity Meter and two LaCoste & Romburg Gravity Meters conducting 2X B-A-B loops to the AFGN station located at Waikerie Airfield. The expected accuracy of the Gravity ties better then 0.01 mGals.

MISCELLANEOUS DETAILS

Daishsat base 464 is located on a fence line 14km to the north of the township of Morgan in South Australia.

Access to the base is by vehicle, 85 kms by track North of the town of Morgan. Morgan is situated on the Murray River in SA. The Base is located on a boundary fence between Old Koomooloo Station and Sturt Vale Station.

Base 464 and distinguishing features

APPENDIX E

Data CD
(Attached To Back Cover)