

OM Manganese Limited



**Masai West, Renner Springs & Helen Springs
Northern Territory**

Surveyed September / November 2013

GPX Project No 2994

**IP Geophysical Survey
Survey Operations and Logistics Report**



Table of Contents

1	GENERAL SURVEY INFORMATION	4
	INTRODUCTION	4
	SURVEY SUMMARY	4
	SURVEY PERSONNEL	5
2	SURVEY SPECIFICATIONS	6
	GENERAL SPECIFICATIONS	6
	OVERVIEW MAP	8
3	EQUIPMENT SUPPLIED BY GPX SURVEYS	12
	CREW	12
	EQUIPMENT	12
	VEHICLES	12
4	ITEMS SUPPLIED BY OM MANGANESE	13
5	FIELD DATA	13
6	FINAL DATA	13
7	IMAGES.....	14
8	GROUND OPERATION SUMMARY	20

1 GENERAL SURVEY INFORMATION

INTRODUCTION

In August 2013, OM Manganese Limited contracted GPX Surveys Pty Ltd to conduct a Gradient array Induced Polarisation survey on their areas located near Helen Springs and Renner Springs in the Northern Territory.

Client:	OM Manganese Limited
GPX Project Number:	2994
Survey Areas:	Helen Springs Renner Springs Masai West
Survey Bases:	Renner Springs Roadhouse, N.T. Bootu Creek Mine Site, N.T.
Mobilisation:	1 st – 7 th September 2013
Production:	8 th Sep – 8 th Oct 2013 (Renner Springs) 21 st – 24 th Oct 2013 (Masai West) 25 th Oct – 3 rd Nov (Helen Springs)
De-mobilisation:	4 th November 2013

SURVEY SUMMARY

The survey crew arrived at the Bootu Creek mine site on the 7th September 2013. They completed a site induction and began to set up the gradient array for the Renner Springs survey from their base of operation at the Renner Springs Roadhouse. The two survey areas were completed on the 8th October and the crew packed up and flew to Perth for a field break the following day. The crew arrived back in Bootu Creek on the 21st October and completed an induction to the pit at Masai on the 22nd October. A small survey was conducted at Masai West from the 22nd – 24th October. The crew then moved to the Helen Springs area and conducted a survey over two areas from the 25th October until the 3rd November. The crew packed up the equipment on the 3rd November 2013 and began to demobilise the following day. To conform to the OM Manganese OH&S policy, a field break was required during the survey.

Daily reports via phone were made with the GPX Perth office and data was emailed on a regular basis.

SURVEY PERSONNEL

The following personnel were involved on this project:

Project Manager:	Ron Creagh
Field Crew Leader:	Francis Thomson
Field Assistant	Graeme Needs
	Iain Stewart
	Michael Sands
Health and Safety Manager:	Robert Blizzard

2 SURVEY SPECIFICATIONS

GENERAL SPECIFICATIONS

The following are the general specifications for the surveys:

Area: Renner Springs 1, N.T.

Configuration:	Gradient array
Line Spacing:	200m
Line Direction:	E-W
A space:	25m
Geophysical Transmitter:	GDD
Tx Current	variable
Tx Frequency	0.125 Hz
Geophysical Receiver:	GDD 16
Rx Readings:	Minimum 2/station
Field Data:	GDD format files
Processed Data:	AMIRA format

Area: Renner Springs 2, N.T.

Configuration:	Gradient array
Line Spacing:	200m
Line Direction:	E-W
A space:	25m
Geophysical Transmitter:	GDD
Tx Current	variable
Tx Frequency	0.125 Hz
Geophysical Receiver:	GDD 16
Rx Readings:	Minimum 2/station
Field Data:	GDD format files
Processed Data:	AMIRA format

Area: Masai West, N.T.

Configuration: Gradient array
Line Spacing: 50m
Line Direction: E-W
A space: 25m
Geophysical Transmitter: GDD
Tx Current: variable
Tx Frequency: 0.125 Hz
Geophysical Receiver: GDD 16
Rx Readings: Minimum 2/station
Field Data: GDD format files
Processed Data: AMIRA format

Area: Helen Springs, N.T.

Configuration: Gradient array
Line Spacing: 200m
Line Direction: NE-SW
A space: 25m
Geophysical Transmitter: GDD
Tx Current: variable
Tx Frequency: 0.125 Hz
Geophysical Receiver: GDD 16
Rx Readings: Minimum 2/station
Field Data: GDD format files
Processed Data: AMIRA format

OVERVIEW MAP

The following map provides an overview of the planned survey areas.

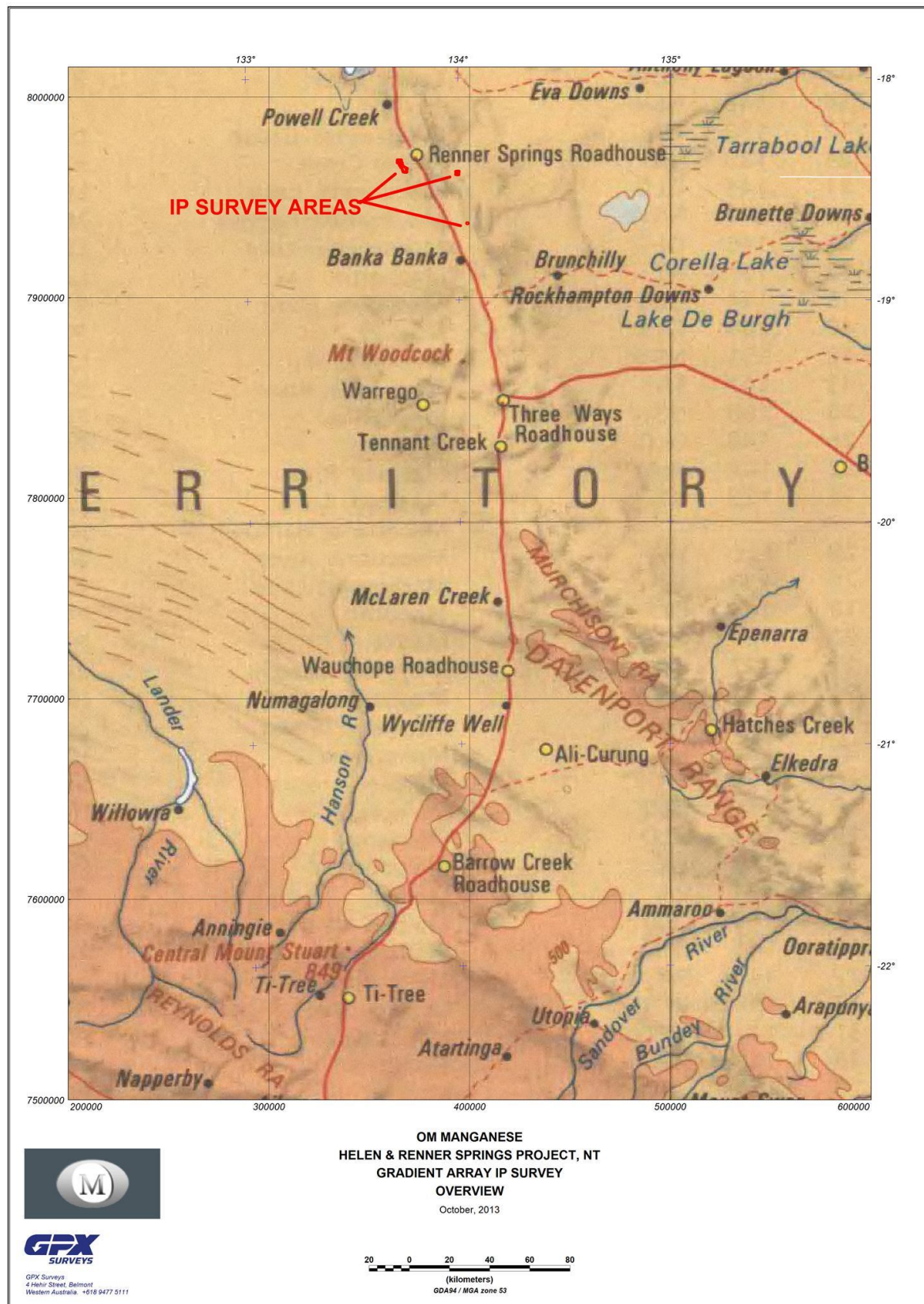


Figure 1: Map of the Survey Areas.

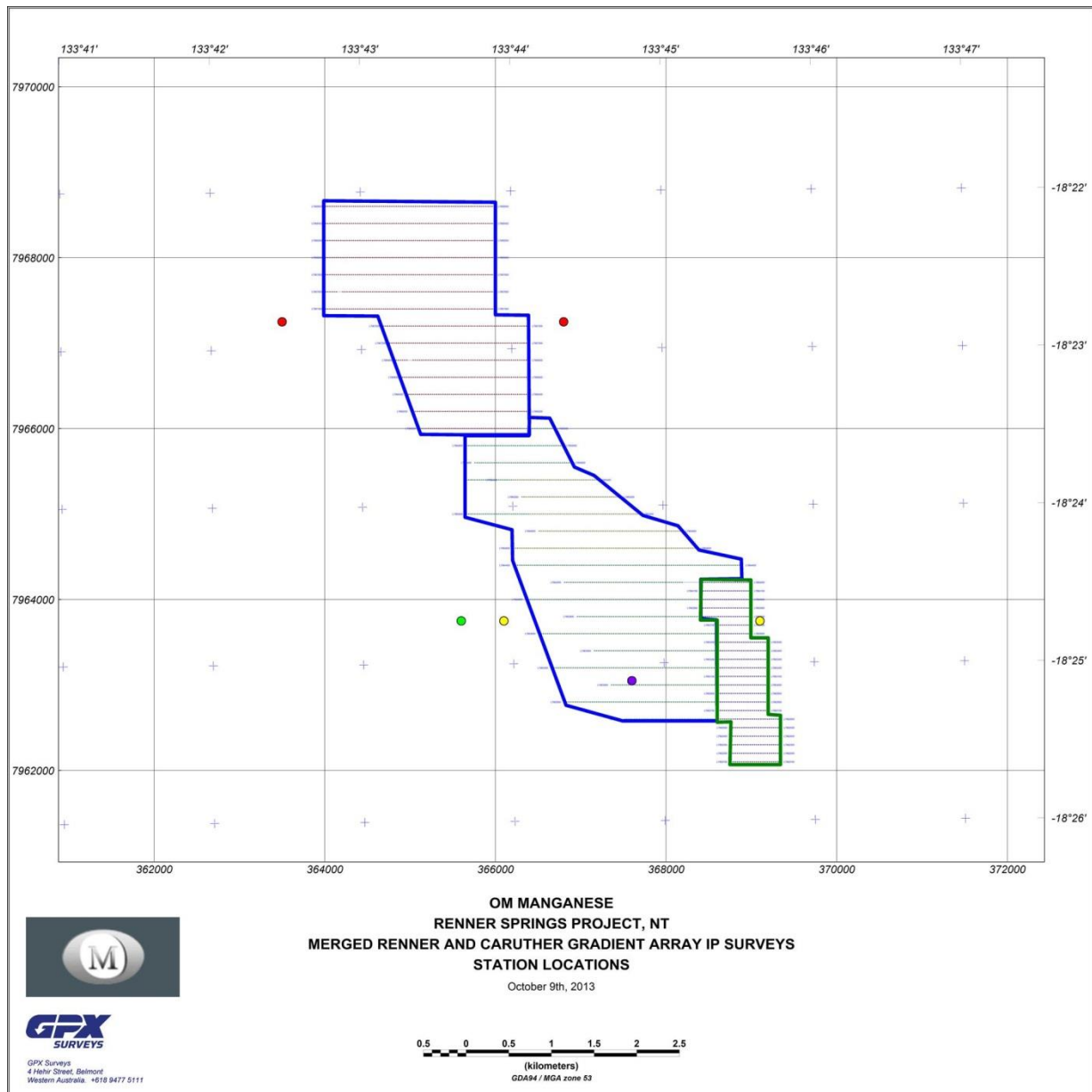


Figure 2: Renner Springs survey areas (blue) with Caruther (2011) survey area (green)

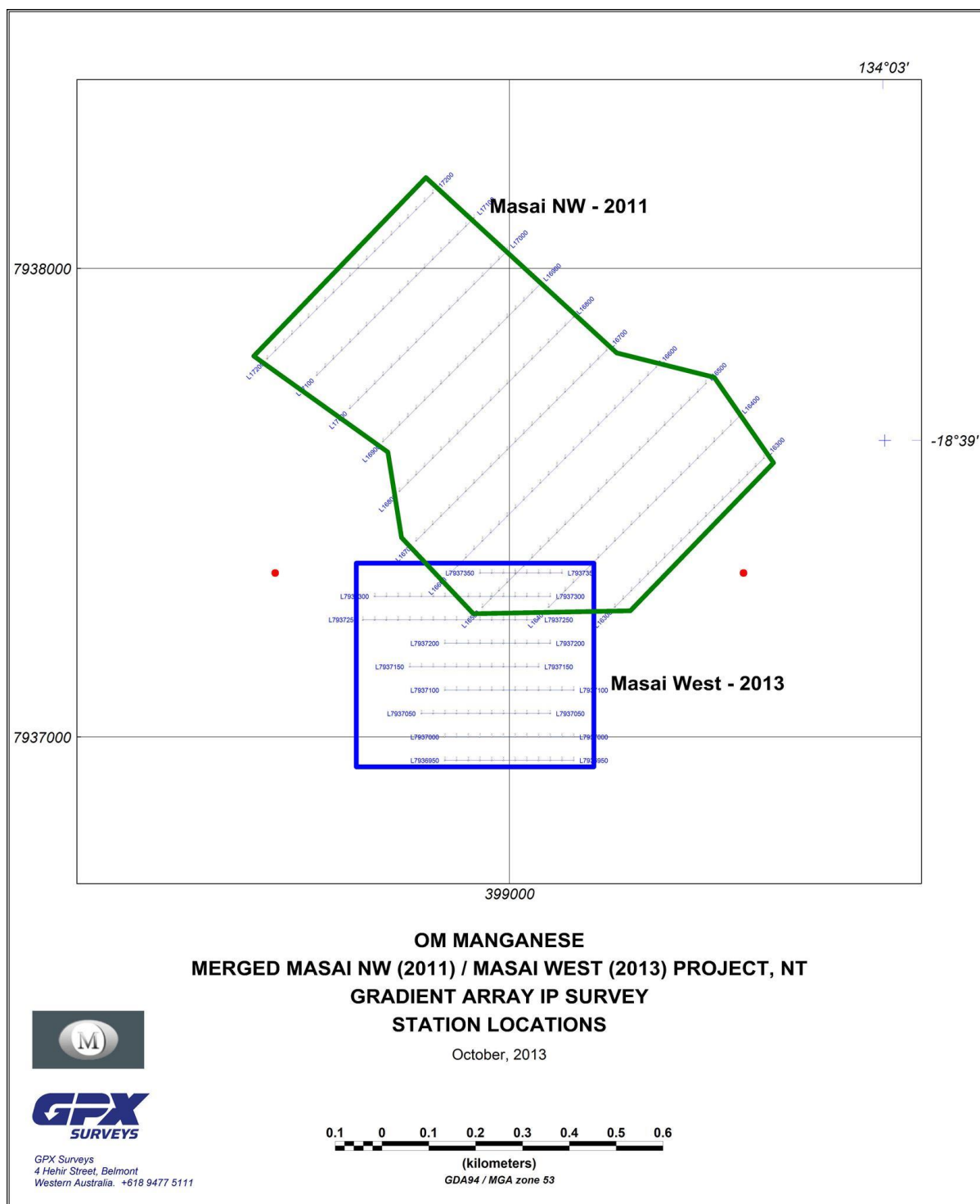


Figure 3: Masai West survey area (blue) with Masai NW (2011) survey area (green)

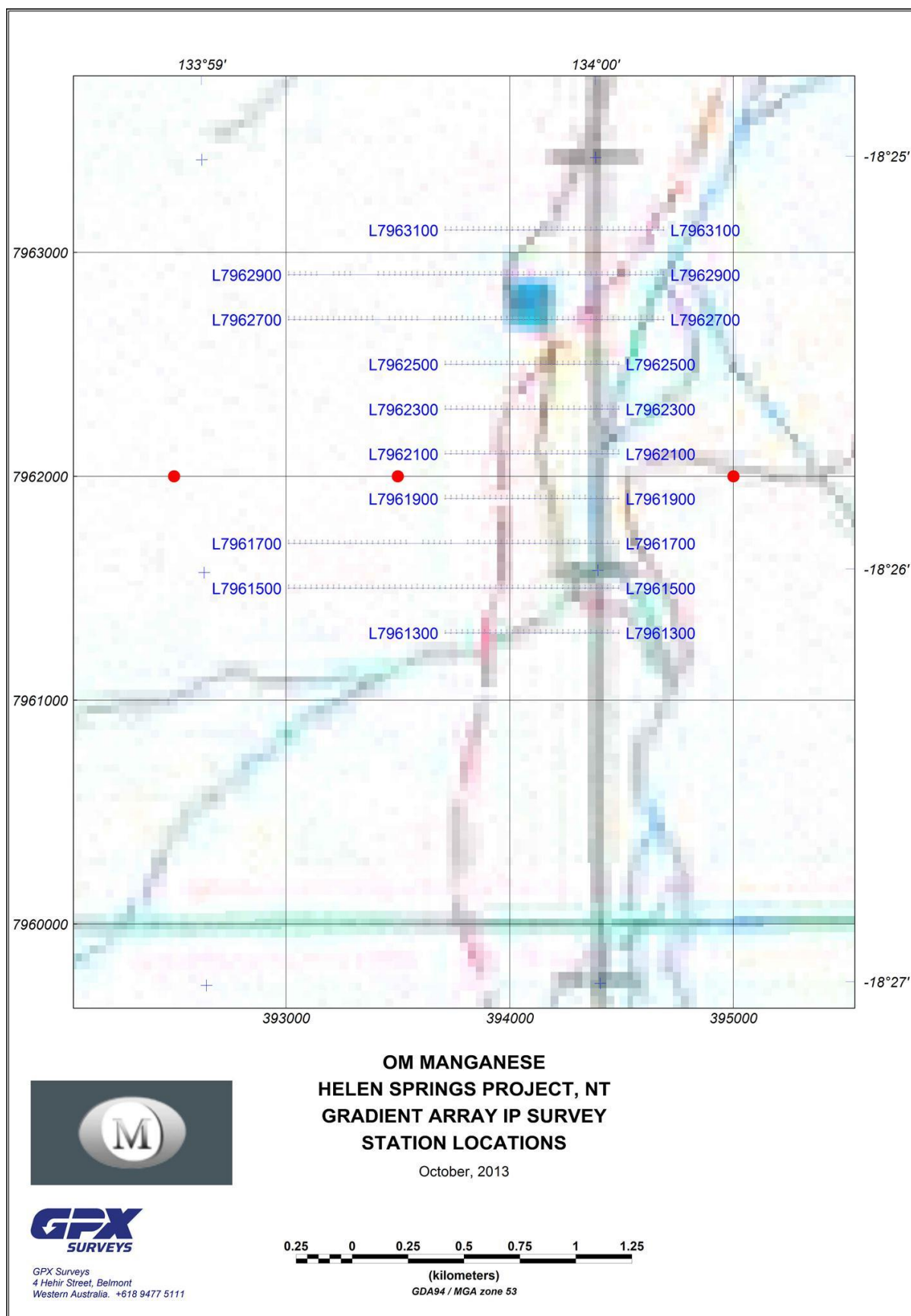


Figure 4: Helen Springs survey area

3 EQUIPMENT SUPPLIED BY GPX SURVEYS

CREW

Experienced four person geophysical crew.

EQUIPMENT

- GDD 16 channel IP Receiver
- GDD Transmitter Controller.
- GDD Geophysical Transmitter.
- 240 volt generator system.
- All wire, pots and accessories necessary for carrying out IP surveys.
- Field Processing Computer.
- Hand Held and vehicle mounted UHF Radios.
- IP Trailer with water tank.
- Hand held GPS receivers.
- Satellite telephone
- Safety documentation including GPX Surveys SWP, JSA and action plans specific to this project.

VEHICLES

Two Four Wheel Drive vehicles and one quad bike.

All vehicles will be fitted with UHF radios, flashing beacons and carry a full complement of spares, fire extinguishers and safety equipment.

4 ITEMS SUPPLIED BY OM MANGANESE

- Survey Area maps and station coordinates.
- Site specific documentation and induction.
- All clearance's or Permits required to work in the survey area.
- Assistance with locating and obtaining access to water for IP electrodes.
- Accommodation and meals for the crew while onsite

5 FIELD DATA

Preliminary Digital data was emailed to the client on a daily basis. Field production reports were provided to the client on a weekly basis or as required.

6 FINAL DATA

At the conclusion of the survey a digital copy of all raw and processed data on CD-ROM were provided.

- Raw ASCII located IP data files (from GDD instrument).
- Processed ASCII located Amira / Geosoft format files for each line.
- ASEG GDF Located data.
- Mapinfo Tiffs
- ERMapper grids
- Logistics Report.

7 IMAGES

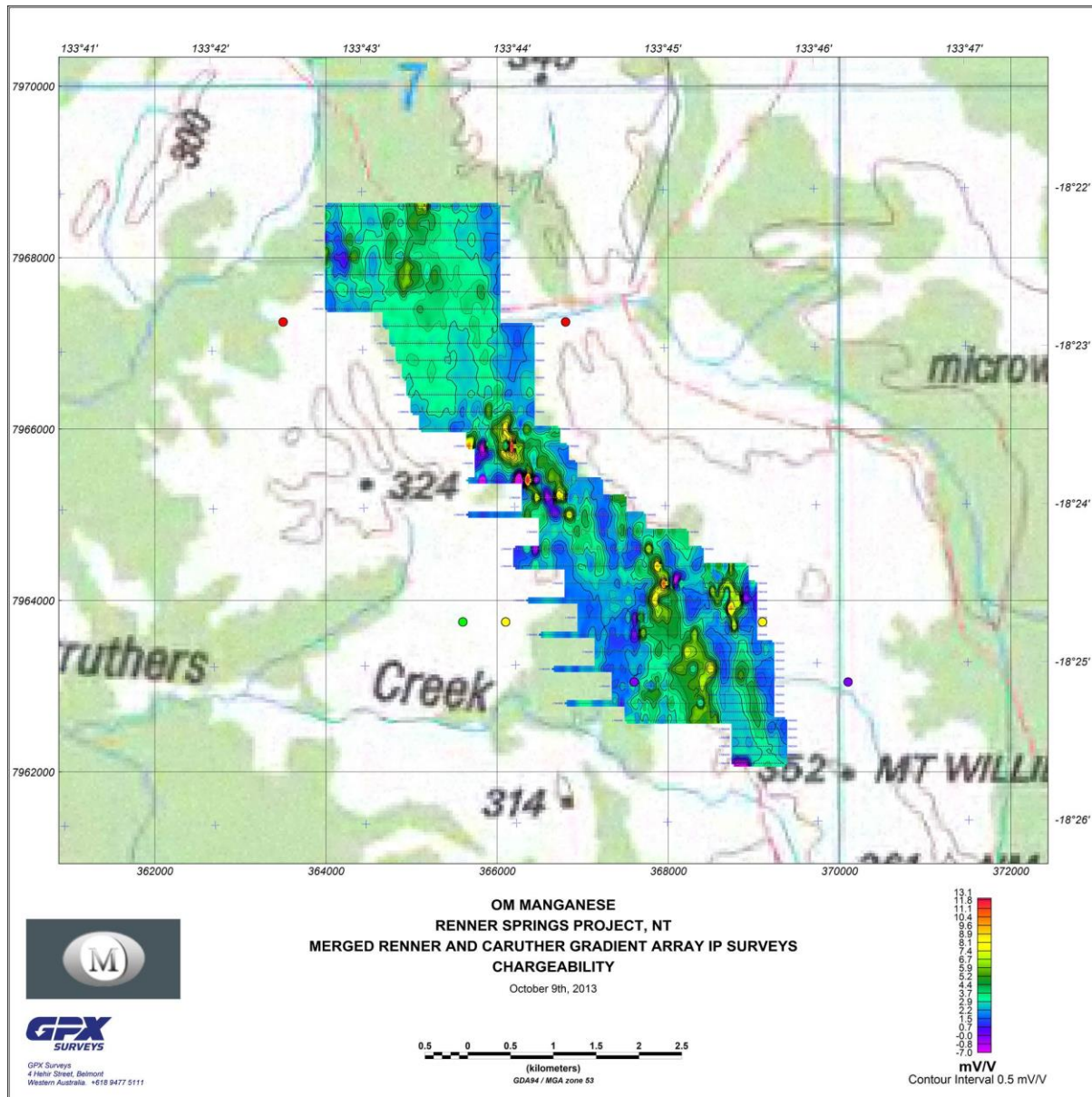


Figure 5: Chargeability of Renner Springs survey area (merged with 2011 Caruthers survey)

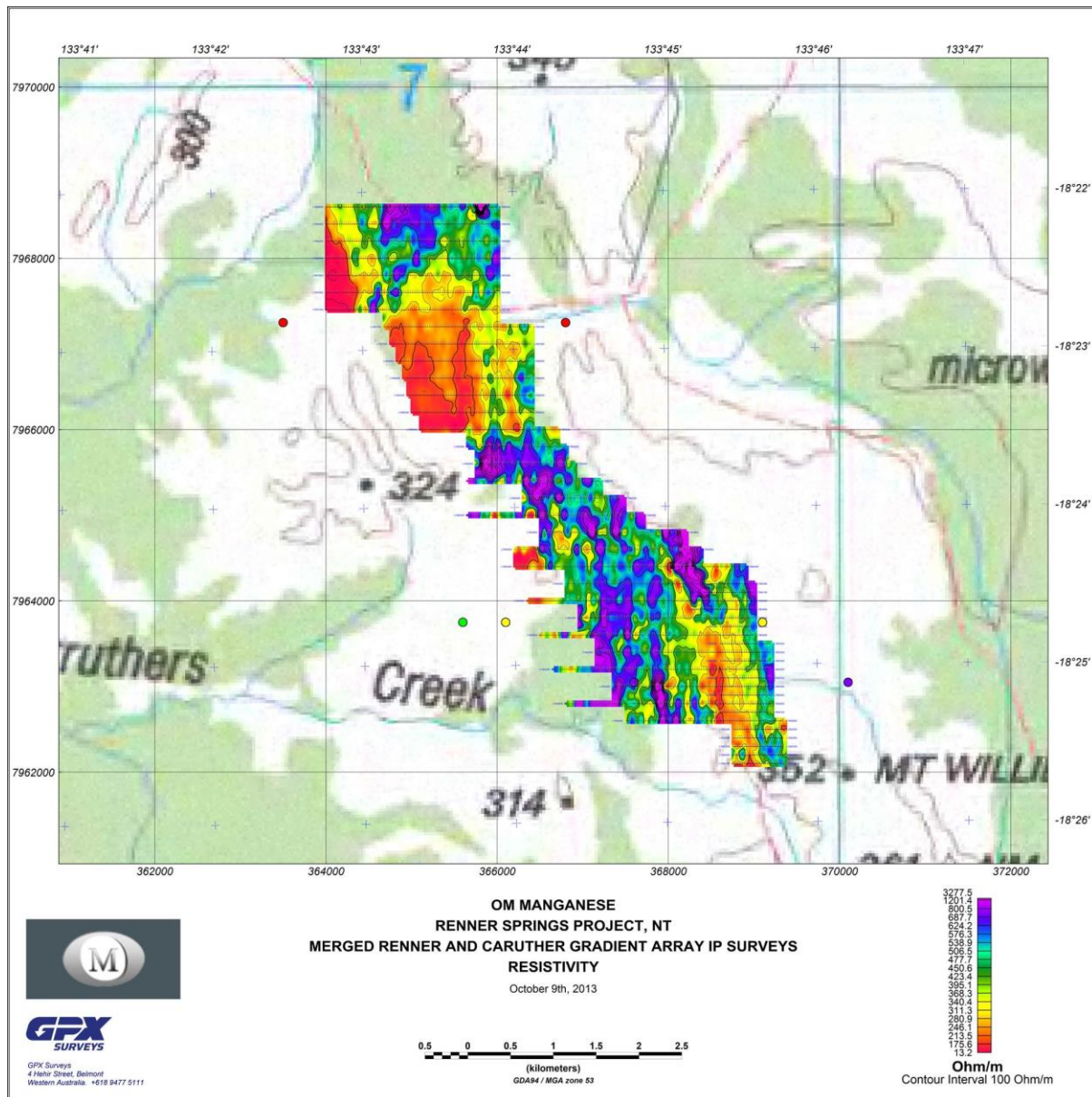


Figure 6: Apparent Resistivity of Renner Springs survey area
 (merged with 2011 Caruthers survey)

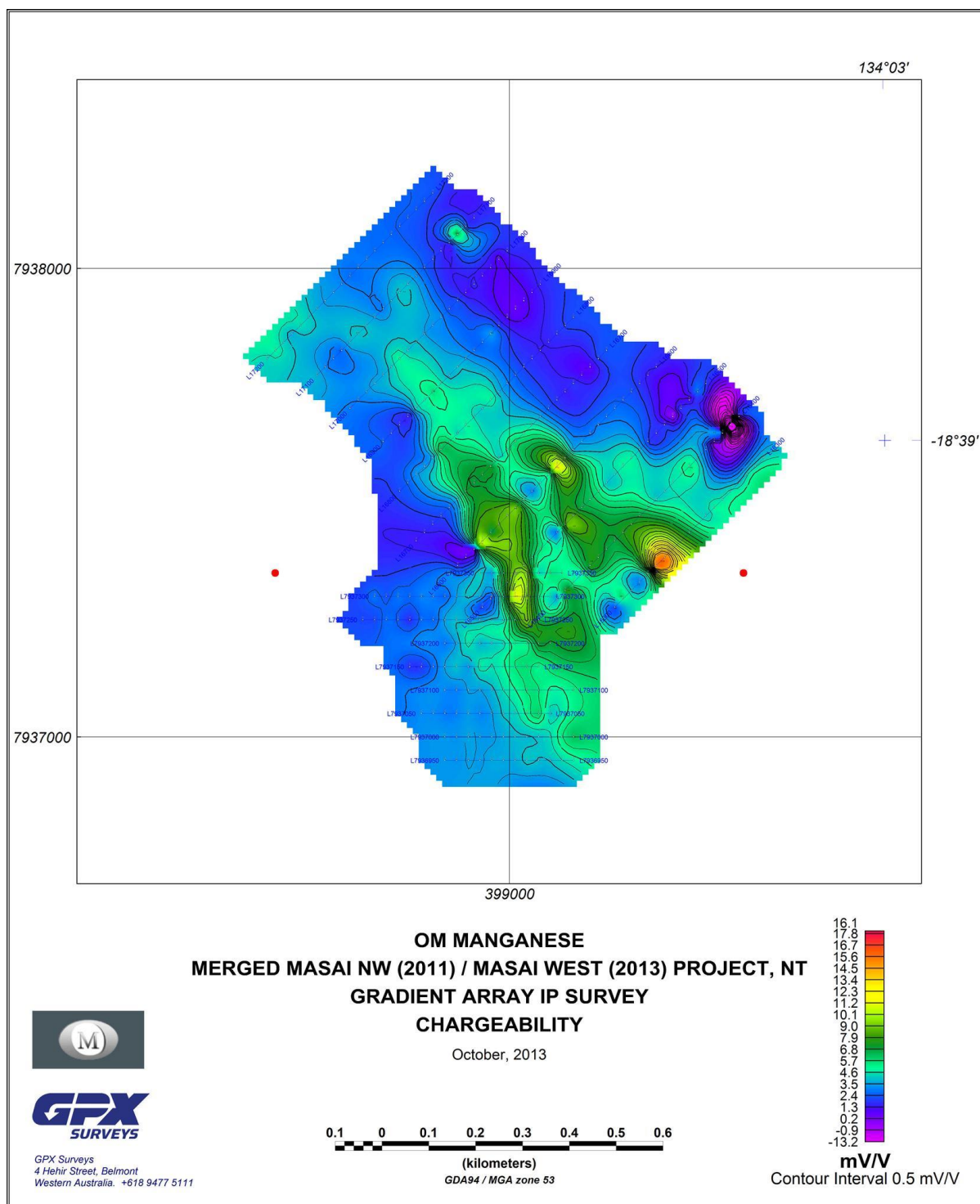


Figure 7: Chargeability of Masai West survey area (merged with 2011 Masai NW survey)

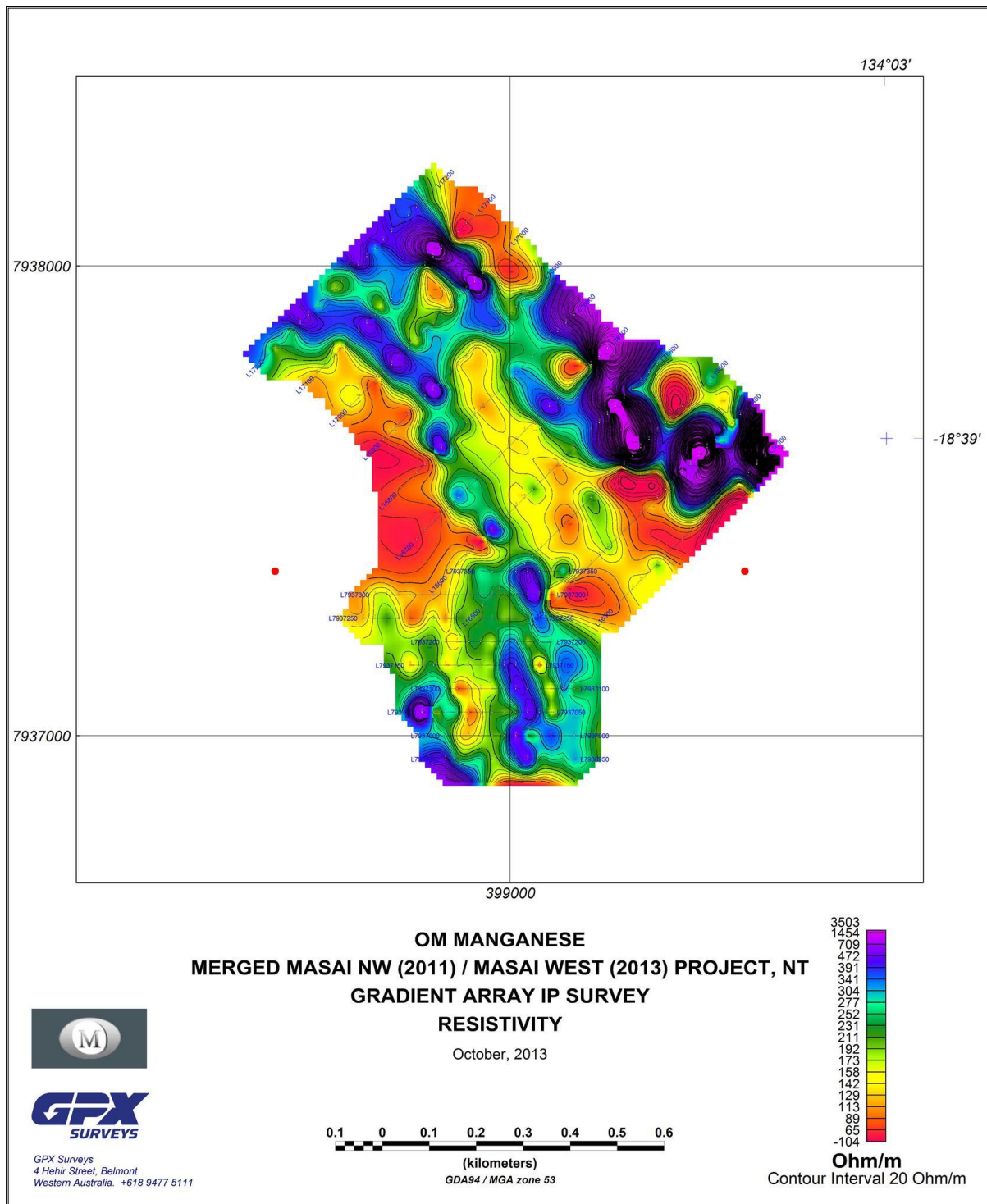


Figure 8: Apparent Resistivity of Masai West survey area (merged with 2011 Masai NW survey)

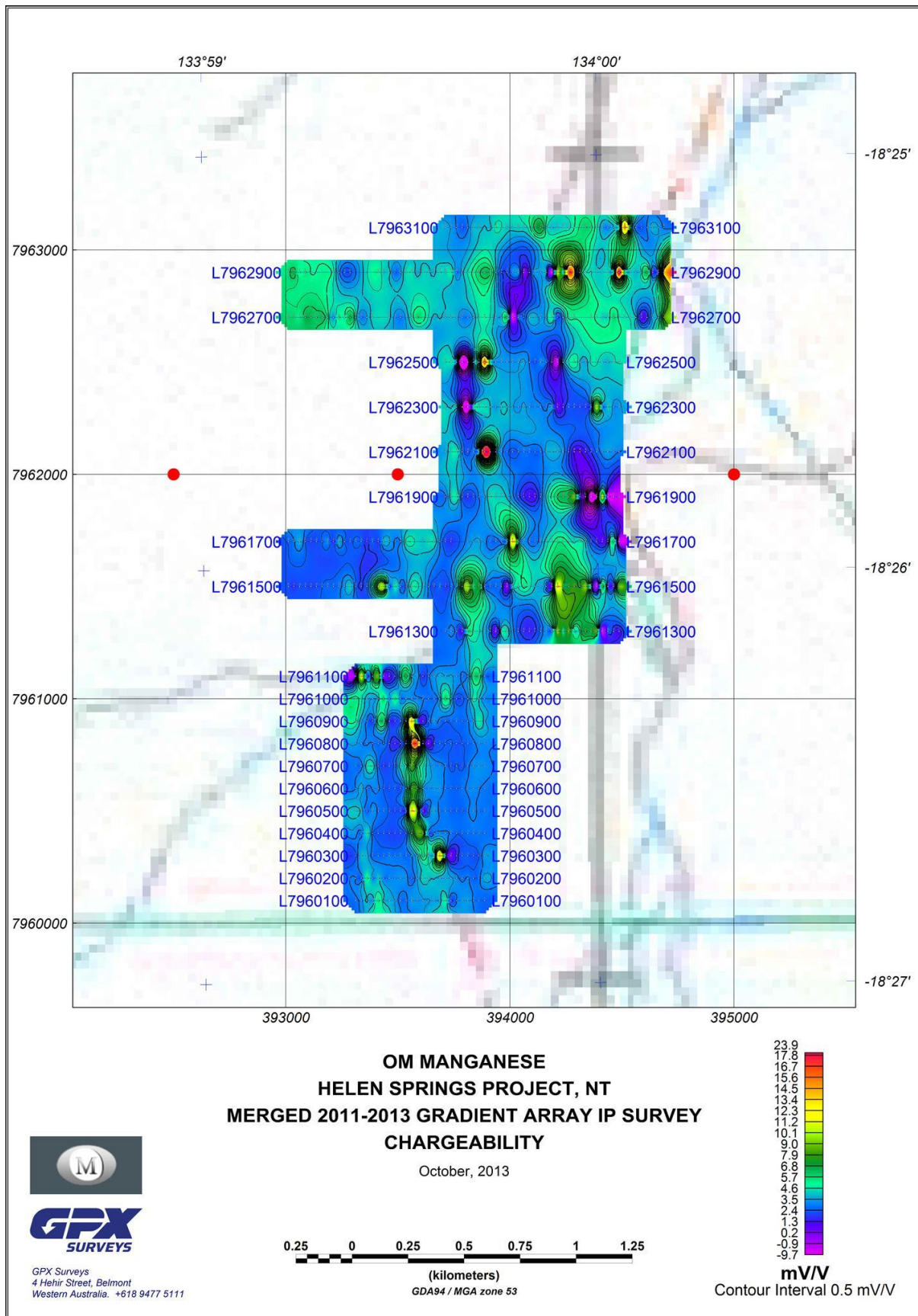
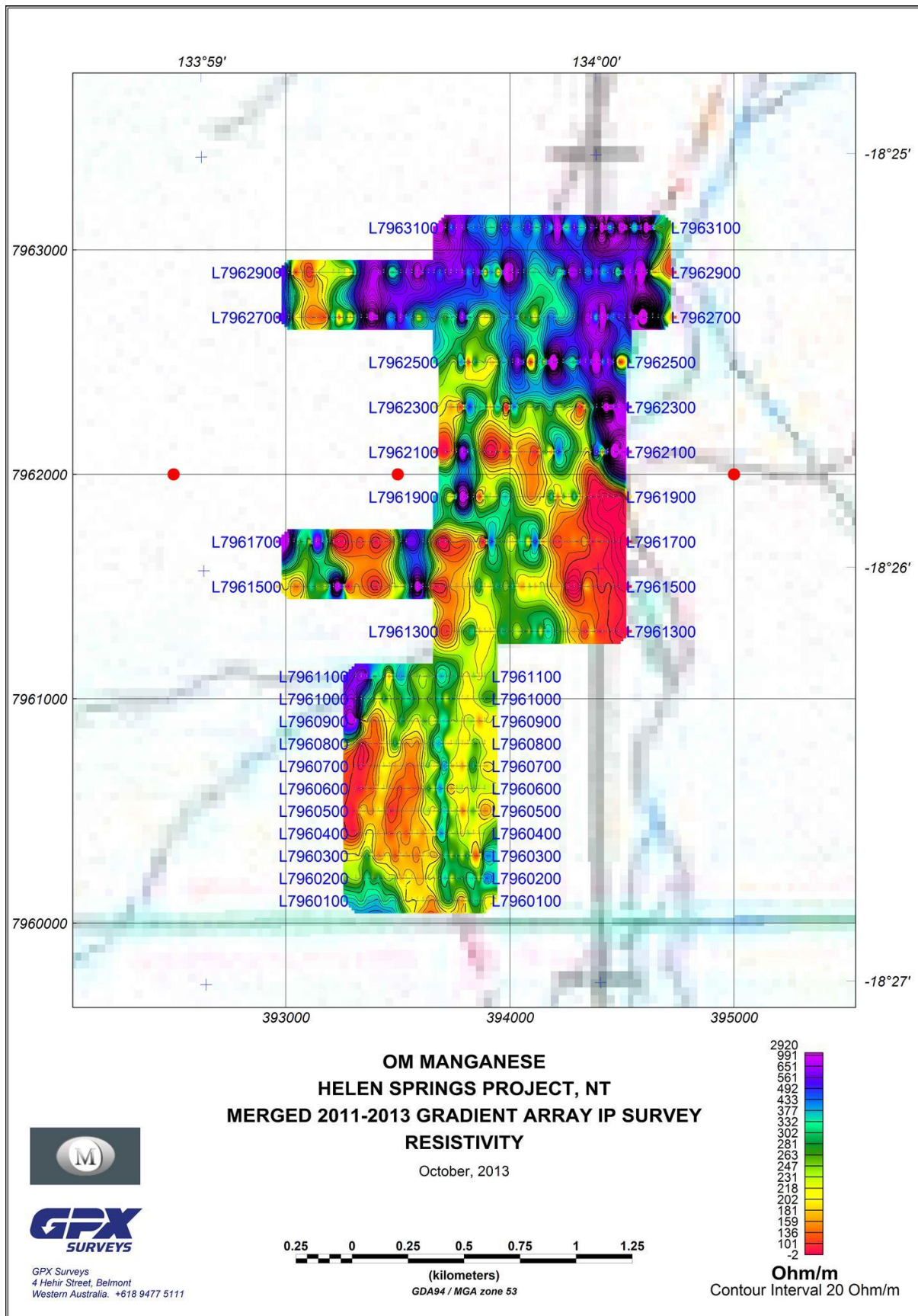


Figure 9: Chargeability of Helen Springs survey area (merged with 2011 Helen Springs survey)



**Figure 10: Apparent Resistivity of Helen Springs survey area
(merged with 2011 Helen Springs survey)**

8 GROUND OPERATION SUMMARY

Location: Bootu Creek
Job: 2994
Month: September 2013
Production: 17.0
Standby days: 0.5
Down days: 5.5
Mobilisation: 7.0
Crew Leader: Francis Thomson

Date	Day	Survey Type	Area	Production	Standby	Down	Mobilisation	Comments
1/09/13	Sunday						1.0	Perth to Norseman with @ vehicles and FPT and Graeme Needs
2/09/13	Monday						1.0	Norseman to Border Village SA
3/09/13	Tuesday						1.0	Border Village to Wudina SA
4/09/13	Wednesday						1.0	Wudina to Coober Pedy
5/09/13	Thursday						1.0	Coober Pedy to Alice Springs
6/09/13	Friday						1.0	Pick up supplies, 2 crew fly in, Michal Sands and Iain Stewart
7/09/13	Saturday						1.0	Alice Springs to Bootu Creek
8/09/13	Sunday	GradientArrayIP	Renner 1	1.0				Induction and meet contact Richard Finch. Proceed to Renner Springs and set up rooms. Take gen set and trailers to site, find water.
9/09/13	Monday	GradientArrayIP	Renner 1	1.0				build Renner one Electrodes, Gradient array and Rx array
10/09/13	Tuesday	GradientArrayIP	Renner 1	1.0				32 stations, 800m, very rough patch 3 puncturs, one fuel line ripped out and one extraction of one Tojo by another
11/09/13	Wednesday	GradientArrayIP	Renner 1	1.0				80 stations, 2kms, one puncture, rewater electrodes, put 20 litres diesels in Carruthers dam, diesel well hole pump, top up dam
12/09/13	Thursday	GradientArrayIP	Renner 1	0.5		0.5		64 staions, then proceed to Tennat creek with 4 staked tyres, pick up 2 more rims, MRFs 14 ply and salt etc
13/09/13	Friday	GradientArrayIP	Renner 1	1.0				144 stations, 18 setups, 3.6kms, one puncture
14/09/13	Saturday	GradientArrayIP	Renner 1	1.0				128 stations, 3.2Kms, 16 set ups, one puncture, rewater el:ectodes, salt western(more resitive) side
15/09/13	Sunday	GradientArrayIP	Renner 1	1.0				144 staionns 18 setups, one puncture 3600m of taverse
16/09/13	Monday	GradientArrayIP	Renner 1	1.0				17 setups, 130 staions, 2 punctures 3250m traverse
17/09/13	Tuesday	GradientArrayIP	Renner 1		0.5	0.5		Pick up fuel from Bootu Creek Mine, Tojos and 44, proceed with one spare and 5 flats to Tennant, get other 4 tyres ready to pick up, 5 fixed, return and put two stolen tyres back on water trailer.
18/09/13	Wednesday	GradientArrayIP	Renner 1	1.0				142 staions,, 17 seups, one stuck Tojo, no flats. 3450metres traversed
19/09/13	Thursday	GradientArrayIP	Renner 1	1.0				!24 stations, finish Renner1, 3kms
20/09/13	Friday	GradientArrayIP	Renner 1	1.0				Pack up Renner1 array, dig electrodes and move Tx to Renner2
21/09/13	Saturday	GradientArrayIP	Renner2	1.0				Finish laying cable to electrodes, Start on North line. 87 readings, 2200m traverse with 11 setups, 2 fuel lines ripped out and one flat.
22/09/13	Sunday	GradientArrayIP	Renner2	1.0				120 stations, 2800m of traverse and 15 setups. Nasty box canyons and odd things
23/09/13	Monday	GradientArrayIP	Renner2	0.1		0.9		Move to new line, read one set up. 8 sssstations, 200m traverse, Tojo died, many hours into heat of day, using sat phone for advise, tow into Renner Springs
24/09/13	Tuesday	GradientArrayIP	Renner2			1.0		Tow in to Tennant Creek to get fixed.
25/09/13	Wednesday	GradientArrayIP	Renner2			1.0		Vehicle repaiere doing nothing
26/09/13	Thursday	GradientArrayIP	Renner2			1.0		Arrange rental ex Darwin, organise trip, at end of day news of repair to Toyota trayback.
27/09/13	Friday		Renner2	0.4		0.6		Pick up Vehicle from repaiersin Tennant creek, return to Renner Springs, go to site rewater elaelectrodes, one flat tyre. 5 setups, 40 stations 1000m traverse
28/09/13	Saturday		Renner2	1.0				Proceed east as far as possible on 7964600N, Check out line to south, plan full East to West readings on that line to cover old " Carruthers " anomaly North. Take cables West to extend 2 setups West on line 7964600N, so total 32 raedings, 4 setups, 800m traverse in 2 sections. Then move cables to Infill lines to be read off Tx3 being extended 500m West. Fill water trailer and proceed on electroded building, 3 punctures
29/09/13	Sunday		Renner2	1.0				Finish extension op Electrode Tx1 west 500m, Read 2 infill lines, 12 setups 2.4 km traverse, 92 staions. Creek crossing delays.
30/09/13	Monday		Renner2	1.0				Run cables out to East over escarpment, read on all of line 7964400N, 14 setups, 2.8km taverse and 108 stations. Also 2 simutaneous hook ups, about 500m apart. Complex to solve without a winch.

Location: Bootu Creek
Job: 2994
Month: October 2013
Production: 14.9
Standby days: 2.5
Down days: 1.6
Mobilisation 0.0
Crew Leader Francis Thomson

Date	Day	Survey Type	Area	Production	Standby	Down	Mobilisation	Comments
1/10/13	Tuesday	GradientArrayIP	Renner 2	1.0				15 set ups, 2850m traverse 104 stations
2/10/13	Wednesday	GradientArrayIP	Renner 2	1.0				19 setups, 3500m traverse, 116 stations
3/10/13	Thursday	GradientArrayIP	Renner 2	1.0				17 setups, 3050m traverse, 108 stations
4/10/13	Friday	GradientArrayIP	Renner 2	0.4		0.6		6 setups, move to next line North, take all flat tyres into Tennant Creek and fix, pick up previous tyres, new trailer side hitch.
5/10/13	Saturday	GradientArrayIP	Renner 2	1.0				Rewater both electrodes 16 setups, 2 lines, 2.9Km traverse, 116 stations.
6/10/13	Sunday	GradientArrayIP	Renner 2	1.0				16 set ups, 3200m traverse 122 stations, clean up infill
7/10/13	Monday	GradientArrayIP	Renner 2	1.0				
8/10/13	Tuesday	GradientArrayIP	Renner 2					Pack up move to Bootu Creek camp
9/10/13	Wednesday	GradientArrayIP	Bootu Ck		1.0			fly to Perth
10/10/13	Thursday							Field break
11/10/13	Friday							Field break
12/10/13	Saturday							Field break
13/10/13	Sunday							Field break
14/10/13	Monday							Field break
15/10/13	Tuesday							Field break
16/10/13	Wednesday							Field break
17/10/13	Thursday							Field break
18/10/13	Friday							Field break
19/10/13	Saturday							Field break
20/10/13	Sunday							Field break
21/10/13	Monday	GradientArrayIP			1.0			Perth to Darwin to Bootu Creek
22/10/13	Tuesday	GradientArrayIP	Masai West	1.0				Pit Permit Induction then access Masai site though current ops. Set up laydown area. Source water, very dry, water back at mine site. Lay out cable to electrode sites, avoiding scared sites
23/10/13	Wednesday	GradientArrayIP	Masai West	1.0				Dig electrodes and read small infill grid, 9 setups 67 stations. refill tank at mine
24/10/13	Thursday	GradientArrayIP	Masai West	1.0				Extend and infill 4 lines 300m each. Pack up all cables, electrodes. Load up trailers and Tojos with Gen set etc
25/10/13	Friday	GradientArrayIP	Helen Springs	1.0				Go to Helen Springs Station, meet manager, agree on water from home mill or Milla Milla bore, Proceed to site, select Transmitter/gen set site. Build both electrodes and lay out cable, thick scrub, 2 punctures, Blow out on highway on return to Bootu Creek. Front left hand, pulls off road.
26/10/13	Saturday	GradientArrayIP	Helen Springs	1.0				Dipole amps drop overnight, both electrodes in thirsty locations. Get to 4.6 amps, rebuild and extend both electrodes, up to 5.6 amps Read first short line
27/10/13	Sunday	GradientArrayIP	Helen Springs	0.5		0.5		Test all possibilities with problems, coupling?
28/10/13	Monday	GradientArrayIP	Helen Springs	0.5		0.5		Problems with data, try 50m spacing
29/10/13	Tuesday	GradientArrayIP	Helen Springs	0.5	0.5			Read Northern area, Lightning storm halts work
30/10/13	Wednesday	GradientArrayIP	Helen Springs	1.0				Proceed with 25m spacing
31/10/13	Thursday	GradientArrayIP	Helen Springs	1.0				Finish first Tx pair swap to western pair

Location: Bootu Creek
Job: 2994
Month: November 2013
Production: 2.5
Standby days: 0.0
Down days: 0.5
Mobilisation 3.0
Crew Leader Francis Thomson

Date	Day	Survey Type	Area	Production	Standby	Down	Mobilisation	Comments
1/11/13	Friday	GradientArrayIP	Helen Springs	1.0				Work on 25m arra,Wsestern side of 4 Tx matrix.y
2/11/13	Saturday	GradientArrayIP	Helen Springs	1.0				Rebuild all 4 electrodes Reawter, put diesel in Pumpaa at Mila Mila bore, dead cowsDo new line to north, 7963100N and extend 7962900N 200m East. 7962700N 200m east, then mild /thick turpentine killed electronics on Tojo, worked on for 3 hrs then towed into Bootu Creek Minesite, arrive 6.30PM
3/11/13	Sunday	GradientArrayIP	Helen Springs	0.5		0.5		Pack up all at Helen Springs after vehicle fixed, wiring problem, fixed by overnight crew at minesite
4/11/13	Monday						1.0	Bootu Creek to Tennant Creek and Alice Springs
5/11/13	Tuesday						1.0	Alice Springs To Coober Pedy
6/11/13	Wednesday						1.0	CooberPedy to Murray Bridge (Adelaide)
7/11/13	Thursday							
8/11/13	Friday							
9/11/13	Saturday							
10/11/13	Sunday							
11/11/13	Monday							
12/11/13	Tuesday							
13/11/13	Wednesday							
14/11/13	Thursday							
15/11/13	Friday							
16/11/13	Saturday							
17/11/13	Sunday							
18/11/13	Monday							
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