

*Final Operations Report
on the

2007
Wombat 3D Seismic Survey
Seaspray, Victoria

for
Lakes Oil NL
and
Terrex Seismic Pty Ltd*

December 2007 - January 2008



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**DSS has a Quality Management System, externally certified to AS/NZS
ISO9001:2000 standards by SAI Global Pty Ltd, certificate number
QEC10046.**

This project was undertaken for Terrex Seismic Pty Ltd and Lakes Oil NL. The sole purpose of the job was to install and survey 3D seismic lines. The use of the data for any other purpose is not authorised.

Any maps or diagrams contained in this report are a visual representation of the associated digital data only.

All data contained in this report and on the attached CD is deemed to be final and overrides any previous data received from DSS, unless otherwise stated.

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INTRODUCTION

The following report covers the **Wombat 3D Seismic Survey** performed by **Dynamic Satellite Surveys Pty Ltd** (DSS) whilst contracted to **Terrex Seismic Pty Ltd** and **Lakes Oil NL**.

The survey operation was located in the Gippsland region of Victoria. The seismic lines totalled **181.20 line kilometres** and were surveyed at 40-metre station intervals.

All survey operations were completed between the 5th of December 2007 and 8th of January 2008, with a Christmas break from December 22nd to January 2nd.



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INSTRUMENTATION AND PERSONNEL

2.1 Personnel and Logistics

DSS personnel involved in the survey were as follows.

Person	Qualifications	Tasks
Denis Williams	<ul style="list-style-type: none"> • Bachelor of Applied Science (Surveying) - QUT • Bachelor of Information Technology - QUT • 13 Years Seismic Experience 	Project Management Job Startup Surveying
Phil Kaufman	<ul style="list-style-type: none"> • Bachelor of Applied Science (Surveying) - RMIT • Graduate Certificate in Computing - Monash University 	Surveying Software Updating
Daniel Browning	<ul style="list-style-type: none"> • Bachelor of Surveying (QUT) 	Survey crew supervision Surveying Office processing Final Report
Terry Hamilton	Bachelor of Geomatics (University of Tasmania)	Surveying
Cristian Gordini	PhD in Topographic and Geodetic Science (University of Bologna, Italy)	Surveying
Denny Wijedasa	Bachelor of Science	Assisting surveyor

Person	Qualifications	Tasks
Kirra Minenko	Trainee Surveyor	Assisting surveyor
James Hartley	Survey Assistant	Assisting surveyor

Personnel and equipment logistics were supported by the DSS Yeppoon office.

Survey operations were based at the Riverstay Motel in Sale.

2.2 *Equipment*

Equipment provided by DSS and used on this project.

	Description	Qty
<i>Vehicles</i>	Toyota Landcruiser Troop carrier (Rental)	1
	Toyota Hilux 4x4 (Rental)	2
<i>GPS receivers</i>	NovAtel GPS receivers with VHF telemetry	4
	Garmin 172C (Machine mounted)	2
	Garmin 128 (Handheld)	2
<i>Computers</i>	Dell Inspiron Laptop	2
	Fujitsu XP tablet	2
<i>Software</i>	NAV05 field software - DSS	Ver4.21
	MIB for Windows - DSS	Ver6.43
	MapInfo Professional	Ver8.5
	GrafNet GPS Processing Software	Ver7.6
	Transit	Ver 5.5
<i>Printer</i>	Canon iPF610 (A1 Plotter)	1
	HP F2180 (A4)	1
<i>Miscellaneous</i>	Necessary standard surveying equipment	
	Sundry office and transport equipment	
	Field and Office Consumables	



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SURVEY REFERENCE SYSTEMS

3.1 Geodetic Datum

This project was based on the Geocentric Datum of Australia 1994 (GDA94), which is based on the Geodetic Reference System 1980 (GRS80) model defined by the following parameters:

<i>Datum:</i>	GDA94(Geocentric Datum of Australia 1994)
<i>Spheroid:</i>	GRS80
<i>Reference Frame:</i>	ITRF92 (International Terrestrial Reference Frame)
<i>Semi-Major Axis Length:</i>	6 378 137.0
<i>Inverse Flattening:</i>	298.257222101
<i>The Unit of Measure:</i>	International Metre

3.2 Map Projection

Final rectangular coordinates were based on the Map Grid of Australia 1994 (MGA94). Parameters for this projection are as follows:

<i>Projection:</i>	Universal Transverse Mercator (MGA Zone 55)
<i>Latitude of Origin:</i>	0°
<i>Central Meridian (CM):</i>	147° E
<i>Scale Factor at CM:</i>	0.9996
<i>False Easting:</i>	500 000
<i>False Northing:</i>	10 000 000
<i>The Unit of Measure:</i>	International Metre

3.3 Height Datum

All elevations obtained relative to GDA94 have been reduced to the Australian Height Datum (AHD) using the AUSGeoid98 Geoid - Spheroid separation model to determine the geoid-ellipsoid separation (N) for the particular area.

GPS observations are made on the GDA94 datum. The height associated with this datum is an ellipsoidal height (h). The Australian Height Datum (AHD), the height datum associated with MGA94, is an orthometric height which is measured as the height above mean sea level, or the geoid (H).

The function that defines the relationship between the ellipsoid and orthometric heights is:

$$H = h - N$$

Or

$$\text{AHD} = \text{GDA94} - (\text{Geoid / Ellipsoid Separation})$$

The value for the geoid/spheroid separation is interpolated from a national model called AUSGeoid98.

AUSGeoid98 is the third in a series of national geoid models produced for Australia by the Australian Surveying and Land Information Group (AUSLIG). The geoid-ellipsoid data is prepared for the Australian region from:

- EGM96 Global Geopotential Model;
- 1996 Australian Gravity DataBase, from the Australian Geological Survey Organisation (AGSO);
- AUSLIG / AGSO GEODATA nine-second digital elevation model;
- Satellite altimeter - derived free air gravity anomalies offshore;
- Theories, techniques and software developed by Associate Professor Will Featherstone, Curtin University of Technology¹.

AUSGeoid98 N values were interpolated using the GrafNet Version 7.60 software, distributed by Waypoint. Consulting Inc.

¹ Johnston, G.M., Featherstone, W.E. (1998) AUSGEOID98: A New Gravimetric Model for Australia



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SURVEY CONTROL

Survey Control was established on the prospect using RTK GPS connections to nearby PSM's. Two new stations were placed and covered the entire prospect. The coordinates for these two stations were calculated from the three Permanent Marks (PM265300180, PM265300370, and PM390300370), with position and elevation weighted according to the Horizontal and Vertical order.

For the misclose values of all check observations and ties, see **Appendix A - Survey Control, Miscloses and Ties**.



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MONUMENTATION

All lines were pegged at a 40-metre station interval. Red/pink stakes were used for source lines and blue stakes used for the receiver lines. All source stations were numbered, and every even receiver numbered.

No permanent markers were placed in the prospect, however, survey control stations that were placed for the survey remain for future reference.

Pink flagging tape was used extensively, especially through hand carry areas, to denote line locations.



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METHOD OF SURVEY

6.1 Surveying and Chaining

The survey was completed using DSS' RT2 real-time kinematic (RTK) surveying technique. This method enabled both position and elevation coordinates to be acquired in real-time and on the appropriate datum.

The survey method utilised phase data received from US Navy NAVSTAR satellites to provide three-dimensional positioning. When RTK surveying, one receiver was set up as a base station at a known location while the other receiver was used as a remote rover. To obtain real-time capabilities, VHF telemetry is required between the base and the remote GPS receiver.

NovAtel real-time kinematic methods can achieve accuracies of better than $\pm 0.05\text{m}$ in position and elevation, depending on base line length. The expected precision for locating pegged positions is better than 0.3 metres and is generally better than 0.2 metres.

Initialisation of the RT2 rover GPS usually takes as little as 1-2 minutes, although this is greatly dependant on satellite geometry, availability and base line length.

GPS was used for pegging the majority of the prospect. In some sections, where the tree cover was too dense, pegs were placed by hand chaining. Coordinates and elevations were calculated using a chain, compass and clinometer.

6.2 *GPS Processing and Quality Control*

All survey data was immediately recorded internally on the Fujitsu XP Tablets and subsequently downloaded to the office computer each evening.

Quality of the satellite data was monitored by careful examination of the various on-screen quality control statistics produced by the NAV05 software. These checks on data integrity are in the form of standard deviation (or sigma) values for Easting, Northing and Height and are generally better than 0.05 metres.

Any attempt to record positional data where the standard deviation values exceeded 0.1m was highlighted to the surveyor at the time of recording, in which case the GPS was re-initialised in order to obtain a more accurate solution. Any recorded position which fell outside the required tolerances was flagged for further investigation and re-recording if necessary.

Numerous checks on pre-recorded marks were observed during each days survey in order to confirm the integrity of the coordinates of the GPS base receiver and the placed markers.

After data collection, coordinates were checked in the office by determining point to point direction and distance. Profile plots were also examined in detail to identify any height anomalies. Any points showing unusual position or height details were flagged for checking in the field before the delivery of final survey data.



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DATA PRESENTATION

All line files were checked and finalised before the survey crew demobilised from the prospect.

All final data was in UTM grid coordinate format on the MGA94 datum on the GRS80 reference spheroid. All elevations were on the Australian Height Datum (AHD71).

Files produced were:

#.uka	Line data in UKOOA format. (Where # = line name)
#.seg	Line data in SEGP1 format. (Where # = line name)

MapInfo Directory All relevant MapInfo Tables

All files are backed up on digital disks in the Yeppoon office for future reference.

Various A1 size plots of the prospect showing pegged stations, access track, gates and wells were produced for the Seismic Crew.



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SAFETY

DSS personnel are aware of safety conditions concerning all exploration seismic surveys. The DSS “**Quality Policy Statement**” and “**Health, Safety and Environment Policy**” were adhered to at all times.

Each vehicle was fitted with a UHF radio, shovel, first-aid kit, bites and stings kit, vehicle recovery equipment and weekly vehicle maintenance check lists.

Comprehensive vehicle checks were carried out weekly to ensure the safety of all surveyors while travelling. Oil and water levels were checked daily.

Several hand-carry areas were present on the prospect. DSS ensured two people were together when surveying through these areas. Snake bite kits were within close reach when working in these areas.



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OPERATIONAL ASPECTS

The Wombat 3D survey was not completed as efficiently as it could have been. This was primarily due to line clearing starting after the surveyors started placing pegs, and lines being cleared randomly and in no logical order.

Due to these operational issues, the first few days of pegging were done in areas with short grass, resulting in small, disjointed pegged sections. This significantly increased the workload of the supervising surveyor, as he had to constantly scout for suitable sections to peg during the day, and at night the time required for office reductions were substantially greater than they should have been.

Clearing for some lines of the prospect was also missed, and/or not sufficient. This slowed the pegging down as these areas needed to be re-visited at a later date.

No days were lost due to Fire Ban Days.

The 181.20 kilometres were pegged by two crews in about sixteen days, giving an average production of more than 11 kilometres per day.

The entire project was accident and incident-free.



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CONCLUSIONS AND RECOMMENDATIONS

For future surveys of this size, line clearing should commence a few weeks before the pegging of lines commences.

On this survey, some lines were still being cleared around our pegged stations as the surveyors departed the prospect.

Comprehensive A1 plots were provided to the crew to enable quicker access solutions to shoot the 3D project.

Signed,

Dynamic Satellite Surveys Pty Ltd

Daniel Browning

Senior Surveyor



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APPENDICES

Survey Control, Miscloses and Ties

Survey Control, Miscloses and Ties

All values are MGA 94 (Zone 55, AHD71)

Control Stations Used

Station	Easting	Northing	Height	Comments
Base1	515382.417	5754346.072	23.476	New Base
Base2	509280.289	5751424.355	22.400	New Base

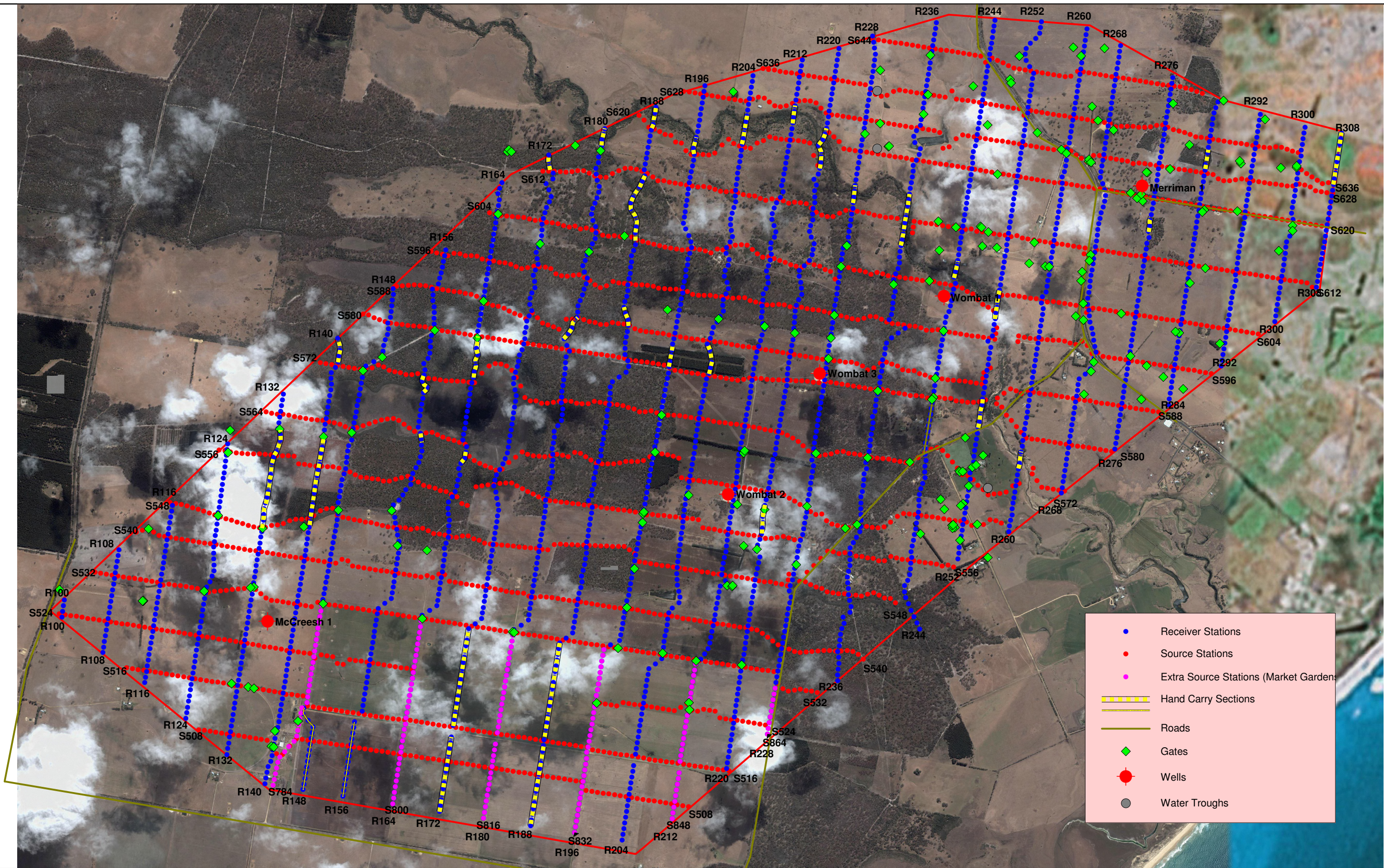
Checks to PMs

Station	Easting	Northing	Height	Comments
PM265300180	516059.91	5753829.55	4.37	(4 th Hz 3 rd Vt) Published
	516059.79	5753829.59	4.37	RTK Connection
	-0.12	0.04	0.00	Misclose

Station	Easting	Northing	Height	Comments
PM265300370	516852.72	5752779.07	1.90	(2 nd Hz 5 th Vt) Published
	516852.72	5752779.06	1.93	RTK Connection
	0.00	-0.02	0.03	Misclose

Station	Easting	Northing	Height	Comments
PM390900370	514603.34	5757800.42	27.80	(2 nd Hz 5 th Vt) Published
	514603.35	5757800.44	27.74	RTK Connection
	0.00	0.02	-0.06	Misclose

Site Diagram



Scale	1:25000 (A3)
Drawn	DW
File	07096 Map
Rev:	0.0
Date	25-01-2008

Line Length Summary

Line Length Summary

Source Lines

Station Interval = 40m

Line	SOL Station	EOL Station	Line Km's
S508	126	212	3.440
S516	112	218	4.240
S524a	99	161	2.480
S524b	194	223	1.160
S532	104	231	5.080
S540	110	238	5.120
S548	115	242	5.080
S556	122	251	5.160
S564	129	258	5.160
S572	137	268	5.240
S580	143	275	5.280
S588	148	282	5.360
S596	153	290	5.480
S604	162	297	5.400
S612	170	305	5.400
S620	185	306	4.840
S628	192	306	4.560
S636	205	306	4.040
S644	223	281	2.320
S784	500	532	1.280
S800	500	532	1.280
S816	500	532	1.280
S832	500	532	1.280
S848	505	532	1.080
S864	522	530	0.320
TOTAL =			91.360

Receiver Lines

Station Interval = 40m

Line	SOL Station	EOL Station	Line Km's
R100	523	526	0.120
R108	518	536	0.720
R116	514	545	1.240
R124	509	557	1.920
R132	504	567	2.520
R140	500	578	3.120
R148	500	588	3.520
R156	500	596	3.840
R164	500	609	4.360
R172	500	615	4.600
R180	500	621	4.840
R188	500	626	5.040
R196	500	631	5.240
R204	500	634	5.360
R212	505	638	5.320
R220	515	641	5.040
R228	522	644	4.880
R236	533	648	4.600
R244	544	650	4.240
R252	557	651	3.760
R260	563	651	3.520
R268	571	649	3.120
R276	580	645	2.600
R284	589	642	2.120
R292	597	641	1.760
R300	606	640	1.360
R308	613	640	1.080
TOTAL =			89.840

Photographs



Lake in northern area.



Pegging out of the Hilux.



Line cleared through bracken.



Wombat #3 Well.