

Power down under

Surrender Report 2011

SEL 26/2005
Partial Surrender July 2011

Authors:

Fiona Holgate

KUTh Exploration Pty Ltd
ABN 33 125 694 920
www.kuthenergy.com

KUTh
E N E R G Y

Abstract

KUTh Exploration Pty Ltd (KUTh) holds four Special Exploration Licences in Tasmania for Category 6 minerals (geothermal substances). The principle target of KUTh's work on these tenements is the location of high-temperature Hot Rock geothermal resources suitable for development as Enhanced Geothermal System (EGS) power generators. This report covers work completed in the years 2006 – 2011 on a portion of tenement SEL 26/2005 recommended for surrendered in 2011. This is the first partial surrender of SEL 26/2005, which was originally granted on 7/8/2006. Surrender will reduce the tenement area by 30% from its original gross extent of 12,360km² to approximately 8400km².

Work commenced and/or completed on the area recommended for surrender during the licence period includes:

- A shallow heat flow drill program comprising 13 holes and 3262.1m drilling (1245.6m RC; 2016.5m DDH). These holes were drilled to ~250m depth on a 20 x 20 km grid across the tenement area during 2008. A complimentary program of geothermometry and sampling for thermal conductivity was completed in April 2009 and estimated heat flow values were returned for all successful holes by May 2009.*
- A reconnaissance magnetotelluric (MT) survey, comprising 44 stations along an east-west profile across the Tamar Valley was completed in October 2008. Modelling of data derived from this survey confirmed the existence of the Tamar Conductivity Zone (TCZ) in this area.*
- Acquisition of ~500 infill gravity stations in the southern area in 2007. Designed to infill an area of otherwise poor data coverage, the interpretation of these results allowed a refinement of the depth to top granite model previously derived from gravity data.*

The combined results of work completed to date indicate that the geothermal prospectivity of the surrendered areas is marginal. Whilst MT data indicate the presence of a significant conductivity anomaly in the crust in the northern section, heat flow values observed here and in the south are both relatively low. Likewise, gravity data interpretation in both northern and southern areas suggests that underlying granite bodies, if present, are likely to be deep seated (>5km depth). Consequently, the potential for exploitable EGS plays in these areas is considered to be low. This being the case, a recommendation for partial surrender of these areas of SEL 26/2005 has been made.

Contents

ABSTRACT	1
1 INTRODUCTION	3
1.1 TENEMENT STATUS.....	3
1.2 LOCATION AND ACCESS	3
1.3 TOPOGRAPHY AND VEGETATION.....	3
1.4 GEOLOGICAL SETTING.....	5
2 PREVIOUS EXPLORATION	6
3 WORK COMPLETED	7
3.1 SURFACE HEAT FLOW DRILLING	7
3.1.1 <i>Drilling</i>	7
3.1.2 <i>Down-hole temperature logging</i>	8
3.1.3 <i>Thermal conductivity measurements</i>	10
3.1.4 <i>Surface heat flow estimation</i>	11
3.2 MAGNETOTELLURIC (MT) SURVEYS.....	12
3.2.1 <i>Location and Planning</i>	12
3.2.2 <i>Data Acquisition</i>	13
3.2.3 <i>Modelling and Interpretation</i>	13
3.3 INFILL GRAVITY DATA ACQUISITION.....	14
3.3.1 <i>Location and Planning</i>	14
3.3.2 <i>Data Acquisition</i>	14
3.3.3 <i>Data Processing</i>	15
3.3.4 <i>Data interpretation</i>	16
4 CONCLUSION AND RECOMMENDATIONS	17
5 ENVIRONMENT	18
5.1 DRILLING REHABILITATION	18
6 REFERENCES	19
7 KEYWORDS	19

List of Tables

Table		Page
1	Tenure details for SEL 26/2005	3
2	Collar information for shallow heat flow program.	7
3	Geological summaries of drilling program.	8
4	Summary of bottom hole temperatures from drilling program.	10
5	Thermal conductivities for dominant lithology of each drill hole.	10
6	Summary of heat flow values of shallow heat flow program.	11

List of Figures

Figure		Page
1	KUTh Energy map of Tasmanian tenements.	4
2	Regional geology map of Tasmania	5
3	Location map of drill holes with surface heat flow estimations	9
4	Location map of MT stations	12
5	2D inversion model profiles MT survey by Adele Manzella.	13
6	Results of infill gravity survey.	15
7	Recommended partial surrender SEL 26/2005	17

List of Appendices

Appendix 1	Logging codes for drill logs
Appendix 2	Drill logs
Appendix 3	Chip and Core photographs (CD inclusion)
Appendix 4	Down hole temperature reports (HDR PL)
Appendix 5	Thermal conductivity reports (HDR PL)
Appendix 6	Surface heat flow calculation reports (HDR PL)
Appendix 7	Magnetotelluric data acquisition (CD inclusion)
Appendix 8	Magnetotelluric processing report (Adele Manzella)
Appendix 9	Gravity Interpretation (Leaman Geophysics)
Appendix 10	Site photos

1 Introduction

KUTh Exploration Pty Ltd (KUTh) is a geothermal explorer based in Hobart, Tasmania and is the holder of four current geothermal exploration licences in that State. The principle target of KUTh’s work is the location of high-temperature Hot Rock geothermal resources suitable for development as Enhanced Geothermal Systems (EGS) power generators.

This report covers work completed in the years 2006 – 2011 on a portion of tenement SEL 26/2005 recommended for surrendered in 2011.

1.1 Tenement Status

KUTh Exploration Pty Ltd (KUTh) is a subsidiary of KUTh Energy Ltd and is the sole holder and operator of SEL 26/2005, SEL 45/2007, SEL 57/2008 and SEL 15/2010 (Figure 1). All four tenements were granted for periods of five years to search for geothermal substances (Category Type 6). Tenure details of SEL 26/2005 are provided in Table 1.

Tenement Type	SEL
Number	26/2005
Commodity	Geothermal
Licensee	KUTh Exploration P/L
Operator	KUTh Exploration P/L
Area	12,360km ²
Date Granted	7/08/2006
Renewal	07/08/2011

Table 1: Tenure details for SEL 26/2005.

1.2 Location and access

SEL 26/2005 includes much of Eastern Tasmania, extending from the mouth of the Tamar River in the north, south to Hobart and north-east to St Marys (Figure 1). The licence includes part of metropolitan Hobart and all of Launceston. A number of highways traverse the area and provide access along with minor roads, farm and forestry tracks. Numerous areas are excluded from SEL 26/2005, including National Parks, Commonwealth land, a gas pipeline easement and various small historic and other features.

1.3 Topography and vegetation

Topography varies significantly across the tenement area and ranges from flat to undulating coastal and inland plains, to steep granite and dolerite ranges and tors. The maximum elevation range across the tenement area is greater than 1km, rising from sea level at the coast to peaks including Ben Lomond (1573m) in the north and Mt Wellington (1271m) in the south. Vegetation is dominated by dry eucalypt forest and developed pasture although considerable variation is present across the topographic range. Pockets of alpine moorland, wet eucalypt forest, native grassland and scrub, wetland and coastal scrub may be found at various locations across the tenements.

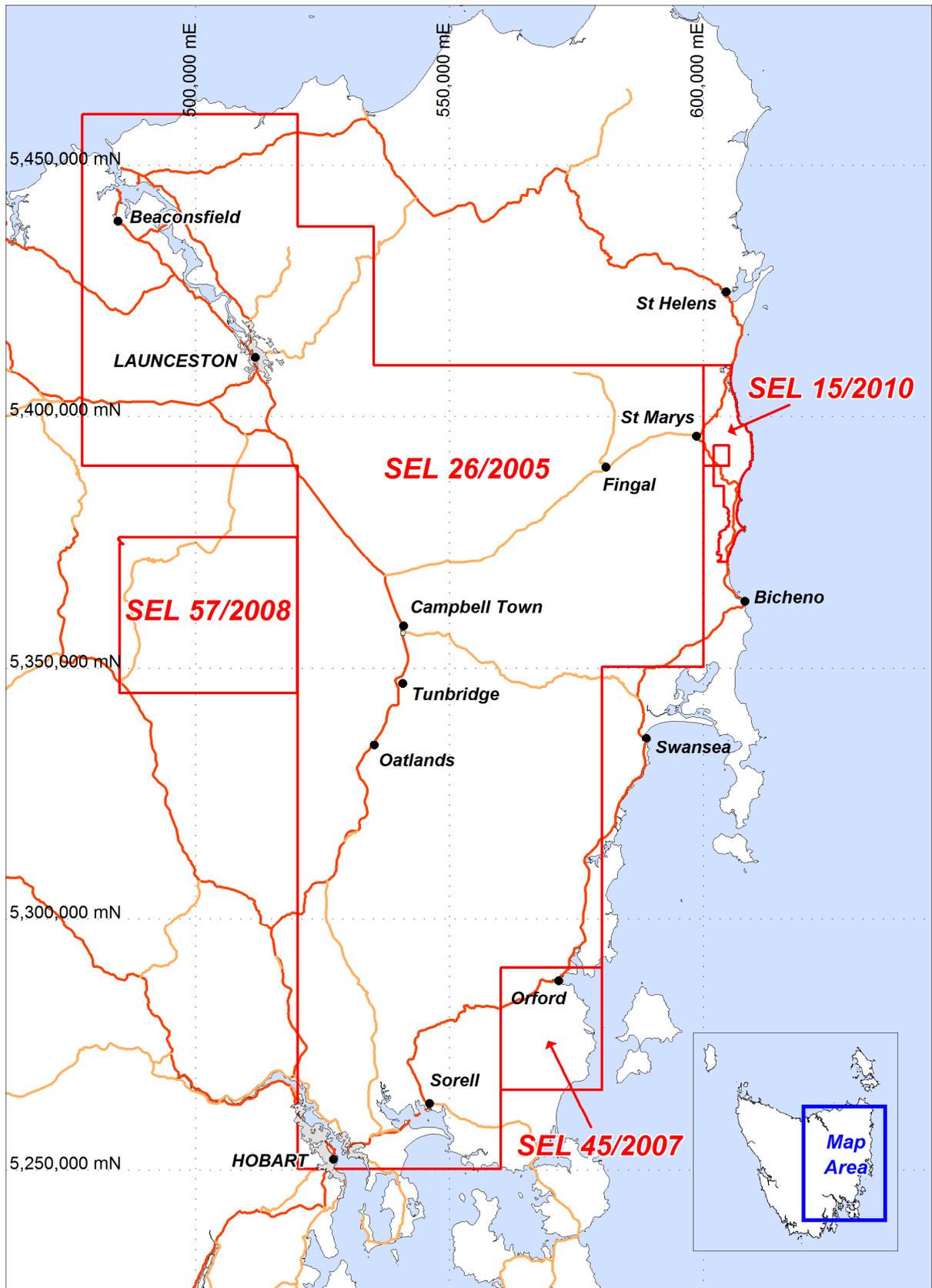


Figure 1: Location map of KUTH Energy Geothermal Special Exploration Licences in Tasmania (red) in relation to major roads (orange) and population centres. (Note this map does not indicate the location or extent of licence exclusions).

1.4 Geological setting

Tasmania is divided into two basement terrains located in the west and east of the State (Figure 2). Distinguished by age, lithology and deformation these two regions are ‘believed to have been juxtaposed at a NNW trending dislocation’ inferred to coincide with the Tamar Valley region in central Tasmania (Burrett & Martin, 1989). The Western Terrain comprises variably deformed and metamorphosed Pre-Cambrian basement, the now-deformed Cambrian volcanics and sediments of the Dundas Trough and Mt Read Volcanic Belt and the Ordovician-Silurian shelf sediments of the Wurrawina Supergroup. In the East, deformed low-grade meta-sediments of the Ordovician – Devonian Mathinna Supergroup comprise deep water turbidite deposits that are analogous to the ubiquitous Tasminide flysch of mainland eastern Australia. Similarities in the deformation and depositional style of the Mathinna Supergroup and mainland Tasminide units has led to numerous attempts to correlate the two, the Mathinna being compared variably to the Melbourne Trough and the Tabberabbera Zone of central and eastern Victoria (Powell & Baillie, 1992; Reed, 2001).

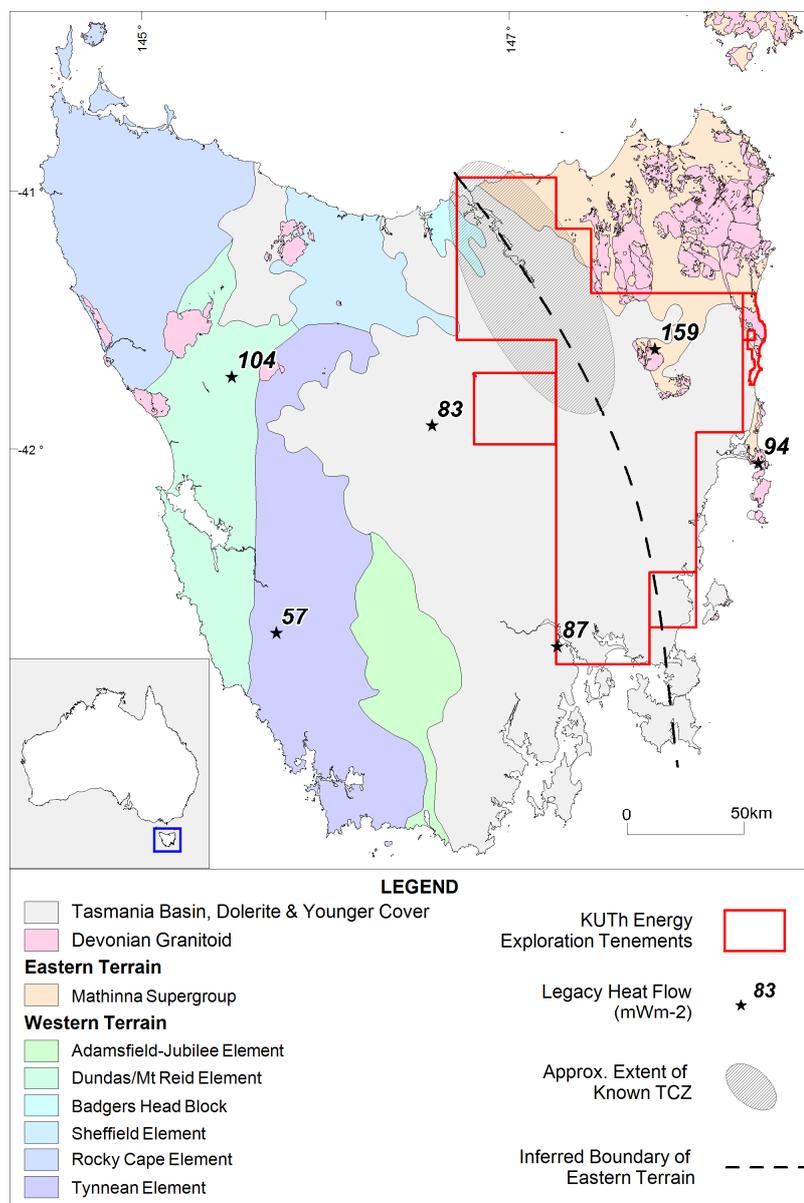


Figure 2: Regional geology of Tasmania showing the major crustal elements. Legacy heat flow data are as summarised by Cull (1991). Also shown is the approximate extent of the known TCZ prior to recent MT survey work.

Across much of the state, basement is concealed by up to 1km of flat-lying Permian-Triassic sediments of the Tasmania Basin and the extensive thick (>300m) Jurassic dolerite sills which intruded these during Gondwana break-up. Mesozoic and Tertiary cover, including extensive dolerite, shale, silt and some coal formations, totally obscure the contact between the Pre-Cambrian Western and Palaeozoic Eastern terrains, which is inferred to underlie the tenement area.

Both Western and Eastern Terrains host Devonian granite, the most extensive intrusions being the slightly older batholiths in the East (Burrett & Martin, 1989). Exposures of Devonian-aged granite in the far north-east of the state are known to include highly-fractionated high-heat-producing (HHP) granites as part of three major suites (Figure 2; Burrett & Martin 1989). To the south and west of this area, the exposed granite plunges beneath cover which potentially provides the insulation necessary for a classic Hot Dry Rock or Enhanced Geothermal System (EGS) target. Complicating this picture is the presence of a known electrical conductivity anomaly observed in the northern Tamar Valley area and referred to as the Tamar Conductivity Zone (TCZ) (Figure 2; Hermanto, 1992). Coinciding broadly with the boundary of the East and West terrains, the TCZ has been interpreted an indicator of fluid in fractured permeable zones (Hermanto, 1992). Intersection between the TCZ and buried HHP granites may thus imply the presence of an existing fracture-permeable geothermal system in Eastern Tasmania.

2 Previous Exploration

KUTh Exploration is the first operator to undertake commercial geothermal exploration work in Tasmania. Legacy geothermal data available in this area are limited to a few early heat flow measurements recorded across the state in the 1950 – 1960s and early 1980s (Figure 2; Cull 1991). Although sparse and of variable quality, these data indicate the presence of high heat flows associated with Devonian granite in the north-east of the state. Heat production data from these granites are available from Collins et al, 1981, and include values of up to 60 $\mu\text{W}/\text{m}^3$ for granites at the Royal George Mine.

The presence of the Jurassic dolerite across much of the tenement area has limited exploration for most commodities in this region. With the exception of small areas around Storey's Creek and Fingal in the north-east of the tenements, relatively few drill holes have been cut. Stratigraphical holes at Tunbridge, Ross and Glenorchy provide the deepest information from the central tenement area but are all <1km deep. Attempts by KUTh in 2006 – 2007 to undertake a surface heat flow measurement program in existing core holes failed due to a lack of suitable open holes.

Available geophysical data includes aeromagnetic and gravity coverage. Data quality is patchy leading to an early decision by KUTh to undertake infill gravity survey work across the south-east of the tenement area.

Studies of magnetotelluric field data identifying a possible conductive anomaly in Northern Tasmania date back to the mid-1970's and are summarised in Hermanto (1992). This work consistently indicated the presence of a broad zone of anomalously high electrical conductivity, approximately parallel to the NW trending axis of the northern Tamar Valley, and extending for some distance to the south (Figure 2). The anomaly appeared at depth, beneath Mesozoic cover, but no direct information was available regarding the nature or detailed structure of the geology associated with it. However, it was concluded that 'the most likely cause of the high conductivity anomaly is a combination of the presence of high

conducting fluids and graphite in pores, cracks, and or fractured rocks' implying the potential for fracture permeability associated with this feature (Hermanto, 1992).

3 Work Completed

Work undertaken across the surrender areas between 2006 – 2011 comprises shallow heat flow drilling, reconnaissance magnetotelluric survey and infill gravity data acquisition.

3.1 Surface Heat Flow Drilling

A program of shallow drilling for heat flow determination comprising 13 holes and 3262.1m of drilling (1245.6m RC; 2016.5m DDH) was undertaken throughout 2008. Collar information for these holes are summarised in Table 2 with full details provided in Appendix 2. Holes were drilled vertically to ~250m depth at 13 sites on a ~20 x 20 km grid across the tenement area (Figure 3). In all cases RC pre-collars were drilled to between 100 - 150m with diamond tails completed to total depth. A complimentary program of geothermometry and sampling for thermal conductivity was completed by contractors Hot Dry Rocks Pty Ltd in these holes in April 2009 and estimated heat flow values were returned for all successful holes by May 2009.

Hole Name	Easting	Northing	RL (m)	Completion	Depth (m)
Bangor	508572	5440427	204	09/06/08	252.2
Beaconsfield	489244	5439884	90	13/11/08	249.6
Cambridge [#]	534378	5261742	43	28/09/08	249.6
Frankford	490171	5416602	289	11/05/08	251.9
Lisle	528218	5437495	307	28/11/08	250.0
Native Hut	530061	5284634	378	16/10/08	249.6
Nunamara	528262	5415737	727	02/06/08	249.7
Perth	513500	5399080	200	26/05/08	252.7
Rocherlea	509171	5420496	49	05/11/08	252.5
Runnymede	546175	5280238	247	07/10/08	249.5
Sorell	550181	5260122	50	06/08/08	251.2
Westbury	485940	5396730	233	20/05/08	252.0
Weymouth	508409	5457196	102	21/11/08	251.6

Table 2: Collar location data for holes in the shallow heat flow drilling program. All holes are vertical. All coordinates are MGA94 Zone 55. [[#] this hole also referred to as University Farm]

3.1.1 Drilling

Drilling was undertaken by Gerald Spaulding Drillers Pty Ltd of Devonport. Two rig types were used, a TH 62 percussion drill rig for pre-collar and a G & K 1000 diamond drill rig for diamond tails. Initial pre-collar depths of ~150m were shortened to ~100m during the program. Pre-collars were cased with 125mm Class 12 PVC which was grouted to prevent aquifer damage. On completion of diamond drilling 40mm Class 9 PVC was emplaced from surface to total depth to act as a guide for the thermal probe and was dummy probed to ensure that it was open and clear. A capped, lockable lid was fixed onto HWT casing at the top of the hole which was then left for approximately 2 to 3 months to equilibrate before final temperature logging was undertaken.

Chips from the percussion rig were collected every 3m and logged, photographed and archived. HQ core was placed in trays with up to 1m from each tray wrapped in “Gladwrap” to retain moisture for thermal conductivity measurements. The core was then transported to the MRT core shed where it was logged, photographed and archived. Drilling encountered a range of lithologies from black shales and turbidites of the Ordovician-Devonian Mathinna Group to Jurassic Dolerite and Permo-Triassic and Tertiary sediments (Table 3). Geological logging codes are provided in Appendix 1, detailed geological logs of all holes in Appendix 2 and chip and core photographs in Appendix 3.

Site preparation required for drilling was minimal due to the policy of selecting sites which were already available wherever possible although sumps were required for the diamond drilling. On completion of drilling, the sites were rehabilitated, taking care to ensure that rock, clay and soil were put back in the approximate order to which they had been excavated. Topsoil containing seed-bank was then placed on top.

Hole name	From (m)	To (m)	Geological unit
Bangor	0.0	252.2	SDs
Beaconsfield	0.0	244.3	Jdl
	244.3	249.6	Ru
Cambridge	0.0	6.0	Qu
	6.0	249.6	Tb
Frankford	0.0	190.1	Jdl
	190.1	195.0	Jdl/Ru
	195.0	251.9	Ru
Lisle	0.0	250.0	SDs
Native Hut	0.0	214.7	Ps
	214.7	249.6	Jdl
Nunamara	0.0	223.9	Jdl
	223.9	249.7	Pu
Perth	0.0	252.7	Jdl
Rocherlea	0.0	252.5	Jdl
Runnymede	0.0	15.0	Ru
	15.0	249.5	Jdl
Sorell	0.0	172.0	Pu
	172.0	251.2	Jdl
Westbury	0.0	252.0	Jdl
Weymouth	0.0	251.6	SDs

Table 3: Geological summaries of shallow heat flow holes. Refer to Appendix 1 for logging codes.

3.1.2 Down-hole temperature logging

All successful drill holes were logged by Hot Dry Rocks Pty Ltd using a wireline thermistor probe, a thermometer that relies on changes in electrical resistance to measure temperature changes. Down-hole temperatures were recorded at 1 metre increments to a resolution of 0.001 °C. In most cases, holes were logged twice with a preliminary run at 4 – 6 weeks after drilling followed by a final run 2 - 3 months after drilling. A summary of final and stable temperatures recorded at depth is provided in Table 4. Full results are presented as tables of temperature recorded per metre down-hole and as graphs of geothermal gradients in Appendix 4.

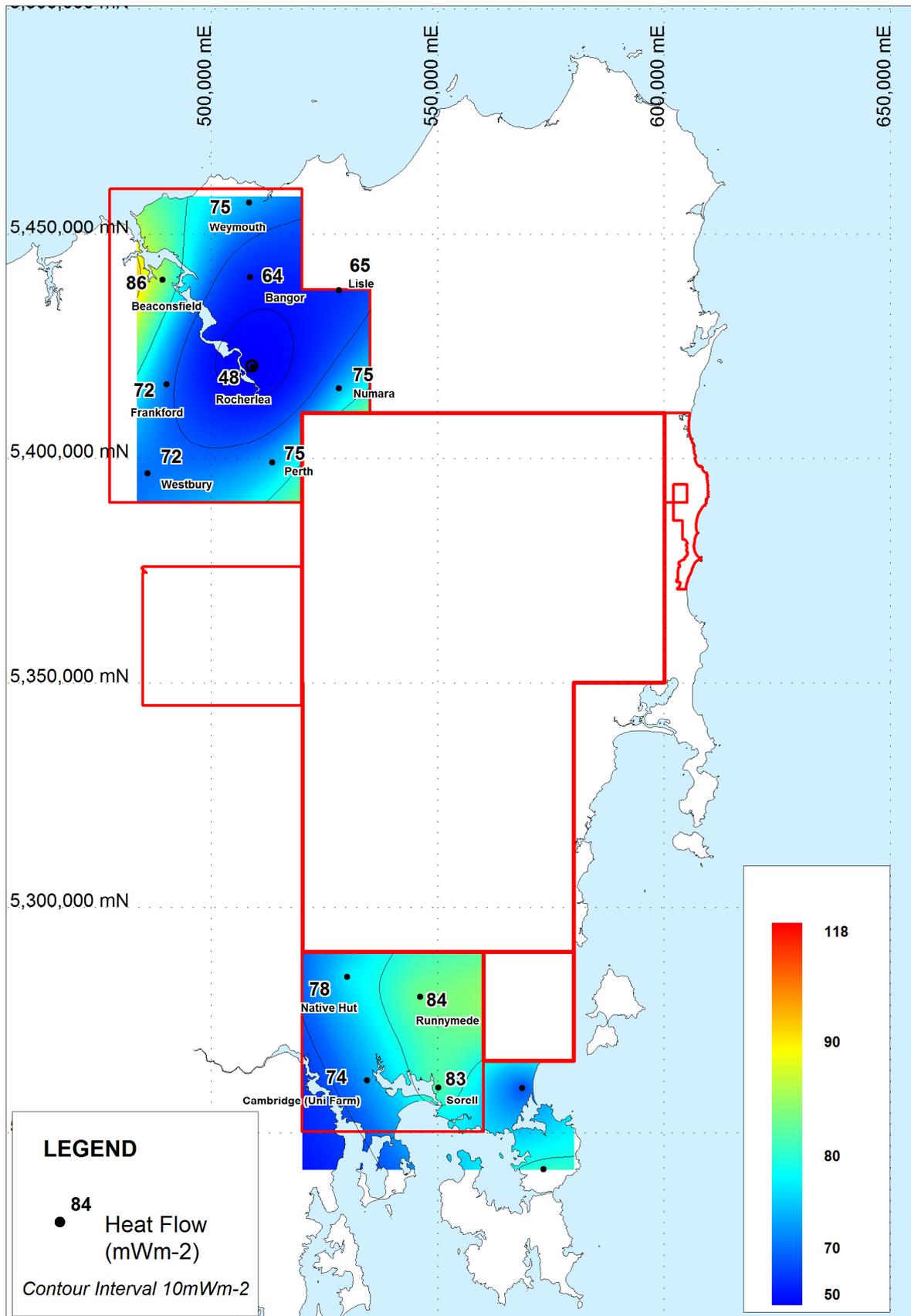


Figure 3: Location of shallow heat flow drill holes with estimated heat flow values (mWm^{-2}).

Hole Name	Bottom hole temperature (°C)	Depth (m)
Bangor	13.0	225
Beaconsfield	22.0	240
Cambridge	20.2	200
Frankford	15.8	245
Lisle	14.6	230
Native Hut	16.0	230
Nunamara	13.3	225
Perth	18.0	240
Rocherlea	20.6	245
Runnymede	18.9	244
Sorell	19.1	212
Westbury	16.8	235
Weymouth	18.5	230

Table 4: Bottom of hole temperatures recorded in shallow heat flow holes.

3.1.3 Thermal conductivity measurements

Measurements of thermal conductivity were undertaken on core samples from all successful holes by Hot Dry Rocks Pty Ltd. Sampling patterns were designed on a hole-by-hole basis using the interim temperature log and a visual assessment of the downhole geology. Each sample comprised a segment of core ~10cm long from which three disks between 1 – 3cm were cut. Cut disks were polished, evacuated via vacuum pump and submerged in water prior to measurement in a divided bar instrument. Values of wet thermal conductivity were recorded in W/mK at a standard temperature of 30°C to a precision of +/- 2°C. The uncertainty for each sample was derived from the uncertainty of the individual disk measurements.

A summary of thermal conductivity measurements from the shallow heat flow program is given in Table 5 and full results are presented in Appendix 5.

Hole Name	Dominant lithology	Thermal conductivity (W/mK)
Bangor	SDs	2.06-3.77
Beaconsfield	Jdl	2.28-2.34
Cambridge	Tb	1.93-2.22
Frankford	Jdl	2.17-2.35
Lisle	SDs	3.18-4.80
Native Hut	Ru	2.19-4.48
Nunamara	Jdl	2.26-2.47
Perth	Jdl	2.07-2.41
Rocherlea	Jdl	1.97-2.25
Runnymede	Jdl	2.17-2.63
Sorell	Pu	2.91-3.76
Westbury	Jdl	2.07-2.21
Weymouth	SDs	2.95-4.02

Table 5: Thermal conductivity ranges given for the dominant lithology of shallow heat flow holes. Refer to Appendix 1 for logging codes.

3.1.4 Surface heat flow estimation

Heat flow is determined as a product of temperature gradient and thermal conductivity. Estimations of surface heat flow (mWm^{-2}) from shallow drill holes provide an indication of the heat flux at a given point on the surface of the Earth. Thermal data derived from the shallow drilling program were input into one-dimensional (1D) conductive heat flow modelling software by Hot Dry Rock Pty Ltd and heat flow for each bore was estimated by comparison of modelled (predicted) and observed temperature values. Results of the heat flow modelling process are summarised in Table 6 below and are presented in full in Appendix 6.

A total of 13 surface heat flow estimations were completed (Figure 3). Shallow advective influences, related to the movement of ground or meteoric water, are interpreted to affect the temperature field in two holes (Table 6). In both cases where shallow water movement is suspected, regional heat flow is assumed to be that value which was observed below the advective influence.

Surface heat flow determined by this program are generally of high quality with good to excellent model fit and uncertainties typically $<5\%$. Only hole *Rocherlea* failed to produce good model fit and is considered to be of relatively low quality.

When mapped, the values of surface heat flow determined from the shallow drilling program are found to be spatially consistent and support interpolation of a smoothly varying thermal field (Figure 3). Heat flow values observed are generally moderate to low ($<90\text{mWm}^{-2}$).

Hole Name	Confidence	Surface HF (mW/m^2)	Error (mW/m^2)	Base HF (mW/m^2)	Error (mW/m^2)	Comment
Bangor	Mod-High	70.0	4.6	64.0	4.2	advective influence at 142-205m, resulting in higher basal heat flow
Beaconsfield	High	86.0	0.4			
Cambridge	High	74.0	1.2			
Frankford	High	72.0	2.2			
Lisle	High	65.0	0.5			
Native Hut	High	78.0	1.8			
Nunamara	High	75.0	1.1			
Perth	High	75.0	1.1			
Rocherlea	High	48.0	0.4			anomalously low value
Runnymede	High	84.0	2.5			
Sorell	High	83.0	1.1			
Westbury	Mod-High	60.0	1.3	72.0	1.3	advective influence at 140m, resulting in higher basal heat flow
Weymouth	High	75.0	1.3			

Table 6: Summary of estimated surface heat flow values from KUTh's shallow drilling program.

3.2 Magnetotelluric (MT) surveys

An initial MT survey was undertaken across SEL 26/2005 in September – October 2008. The aim of this work was twofold - to confirm the extent and detailed structure of the Tamar Conductivity Zone and to investigate the application of modern MT techniques in Tasmania. Data were recorded along an east-west line in the north of the tenement. Results, including 1 and 2D modelled profiles, were returned in January 2009 and confirmed the existence of the TCZ in this area.

3.2.1 Location and Planning

In order to test the applicability of natural-source MT survey techniques it was decided to undertake an east-west orientation line across SEL 26/2005 to the north of the tenement across the Tamar Valley. The line was 43.9km long striking 70°ENE and started approximately 8km west of Exeter (Figure 4). It commenced on Permian sediments, crossing into recent sediments and Jurassic dolerite in the Tamar River Valley. The last 20km (20 stations) on the east were over folded Ordovician - Devonian Mathinna Beds. At its eastern end, the line traversed out of SEL26/2005 into minerals exploration tenements controlled by Beaconsfield Gold NL. Permission to conduct the MT survey over this ground was granted by Beaconsfield Gold NL. Extensions off tenement at the end of the line were a technical requirement to enable modelling of deeper features in the central part of the survey. A list of MT stations and their locations is provided in Appendix 7.

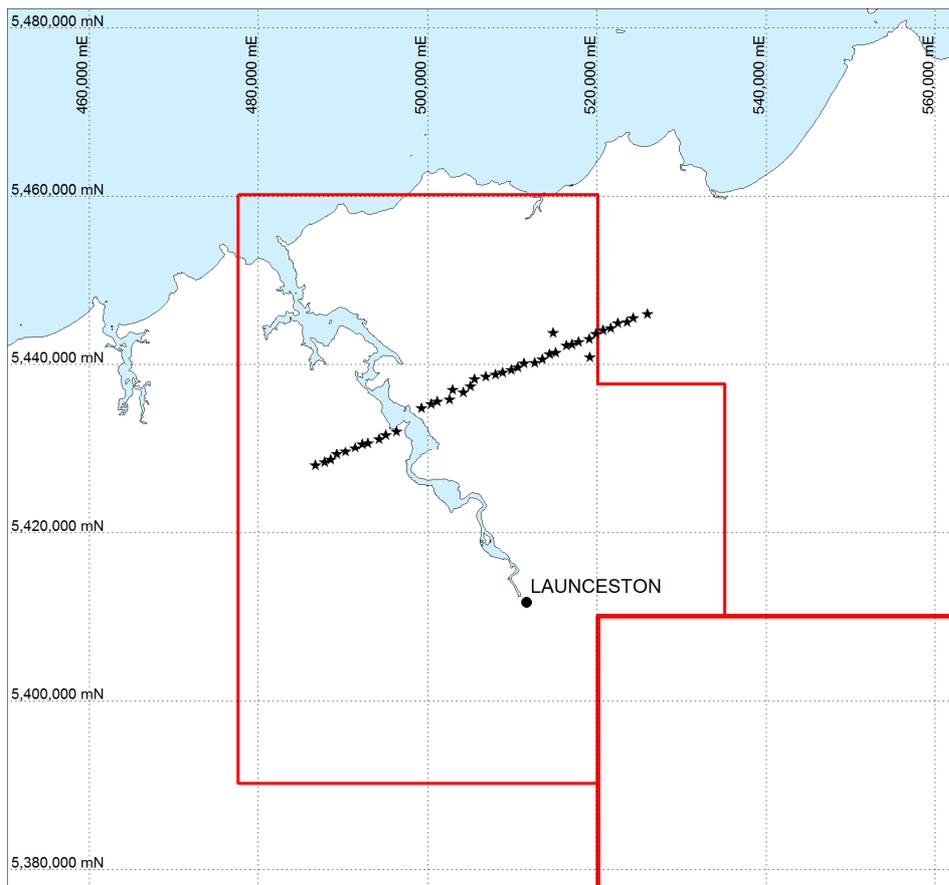


Figure 4: Location map of MT stations (black stars).

3.2.2 Data Acquisition

MT data were successfully acquired at a total of 44 sites by Moombarriga Geosciences using Phoenix systems during late 2008. Full tensor data collection was attempted at every site although digging difficulties in hard and rocky ground prevented collection of Hz at some locations. Stations were left in the ground for ~12 hours to ensure resolution of apparent resistivity and phase data in the range 300 – 0.01Hz.

Data quality was significantly impacted by cultural noise, most commonly attributed to electric fences. Notably, however, the proximity to the DC BassLink interconnector appeared to have no impact on data quality. To counter the effects of noise, a remote station was located in a quiet zone near Oatlands and allowed to record continuously until the end of the survey.

Field data processing undertaken by Moombarriga Geosciences included the conversion of time series data to apparent resistivity and phase curves using Phoenix propriety software. Full details of the data acquisition field processing and results are included in the MT Survey Acquisition Report (Appendix 7).

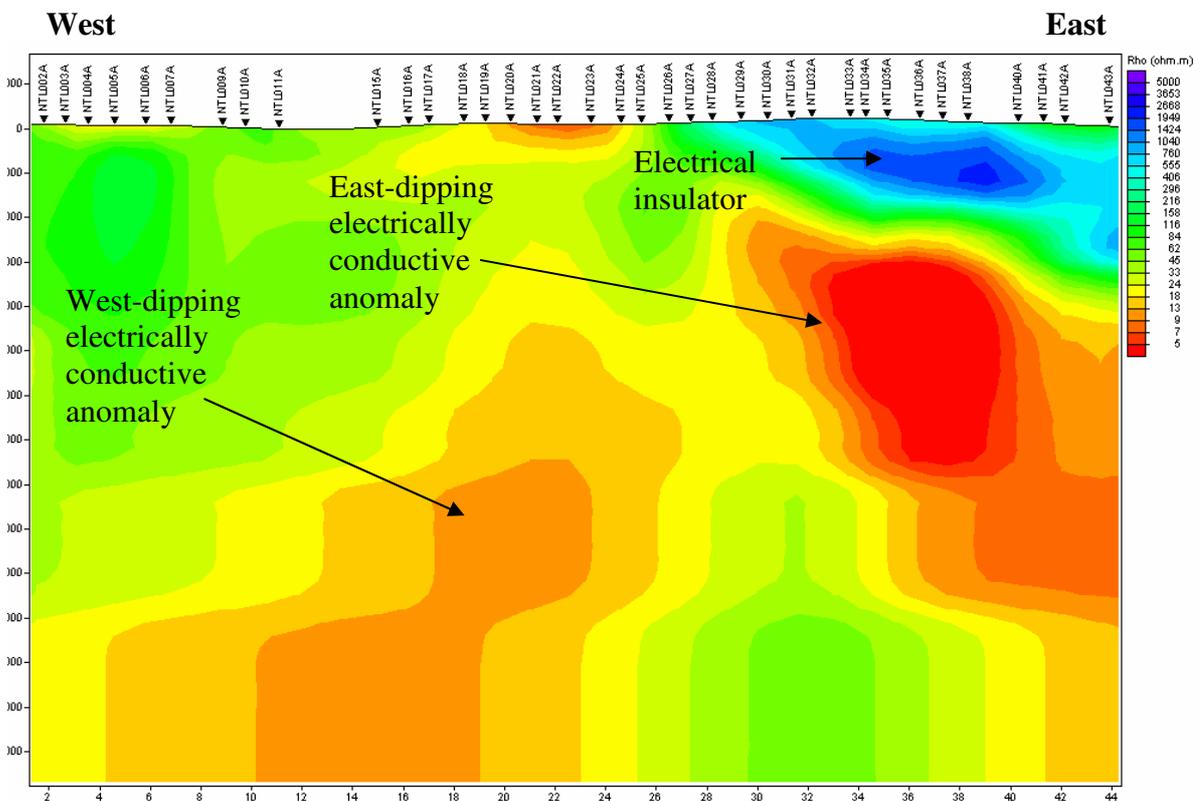


Figure 5: 2D model profiles of the 2008 MT survey. Model is a 2D inversion of TM-TE shifted data using a priori assumptions made on the basis of 1D inversion results. RMS= 18.4. See Appendix 8.

3.2.3 Modelling and Interpretation

Modelling of data generated by this survey was performed by Dr Adele Manzella of the *Consiglio Nazionale delle Ricerche-Istituto di Geoscienze e Georisorse* (CNR-IGG) in Italy. The processed data were found to be of high quality with relatively few incidences of major signal noise. As part of the modelling process Dr Manzella applied a systematic process of data validation to identify, correct or remove poor or biased data. A manually derived 'static

shift' correction was applied to compensate for distortion effects produced in the electromagnetic field by near-surface features.

The 2D model produced by Dr Manzella for this survey is presented in Figure 5. The model has been refined by the use of *a priori* constraints regarding the location of resistive bodies determined in 1D inversion models. No assumptions were made regarding the location, size or intensity of electrically conductive anomalies or of the nature or distribution of the existing geology. Comparisons of TE, TM and joint TE-TM inversion models for the indicate a good agreement implying these data are not influenced by significant 3D effects. Details of Dr Manzella's interpretation are included in Appendix 8.

The model derived from the MT data show the presence of large electrically conductive bodies within the crust in the vicinity of the survey line. A strong east-dipping conductive body is observed at a depth of 2.5km and is interpreted to have a thickness of no less than 2km. This body, together with a weaker west-dipping conductor, confirms the presence of the 'Tamar Conductivity Zone' (TCZ) in this region.

3.3 Infill Gravity Data Acquisition

In 2007 KUTh undertook an infill gravity data acquisition to enable better delineation of the location and depths of granitoid bodies beneath Siluro-Devonian to recent cover.

3.3.1 Location and Planning

Solo Geophysics of Adelaide was contracted to read approximately 500 gravity stations along tracks and roads in the eastern 2/3 of the area bound by the Midlands Highway to the west, the Lake Leake road to the north, the coast of Tasmania to the east and Sorell to the south (Figure 6). With the permission of Mineral Resources Tasmania, some areas not under SEL26/2005 were also surveyed.

3.3.2 Data Acquisition

The survey crew based themselves at Orford as it was central to the survey areas and convenient for RTK GPS control. Gravity control was carried to Orford from Launceston and Hobart airport using a re-established airport station from Mount Pleasant to Hobart. Additional controls were established *en route* from Launceston to Hobart. The local gravity control base at Orford was occupied daily.

GPS survey controls were acquired via internet from the State data base and initially GPS base SPM3444 north of Orford was used. Later, new controls were occupied or created as needed in more remote locations. Listed survey controls were neither numerous nor easily accessible in the survey area and Solo established additional bases of convenience in areas of steep terrain. Position control was via GPS, using a Leica 1200 dual frequency RTK for survey applications, a Garmin GPS60 for local activities, with communication via a radio link 4W/25W UHF on 467.075MHz frequency. All raw GPS survey controls were acquired in GDA94 datum (WGS84) and transformed in real time to survey grid references in AMG66 Zone 55 using the Tasmanian AGD66 transformation and geoid files. All height references are in AHD. The RTK survey resolution was better than 0.05m for horizontal and vertical measurements as satellite availability was usually resolved better than 0.03m. Data were not recorded when a vertical error of 0.05m was exceeded. Tasmanian satellite availability limited useful survey periods in dense vegetation.

Gravity was read using a LaCoste & Romberg Model G #556 gravity meter, appropriately calibrated, in loops from a control station (the field measurement being a relative gravity measurement referenced to the base station control). Meter daily variations closely follow

Longmans tidal calculations. All time references for gravity are EST, or UTM plus 10 hours. All gravity stations were given a unique six digit ID.

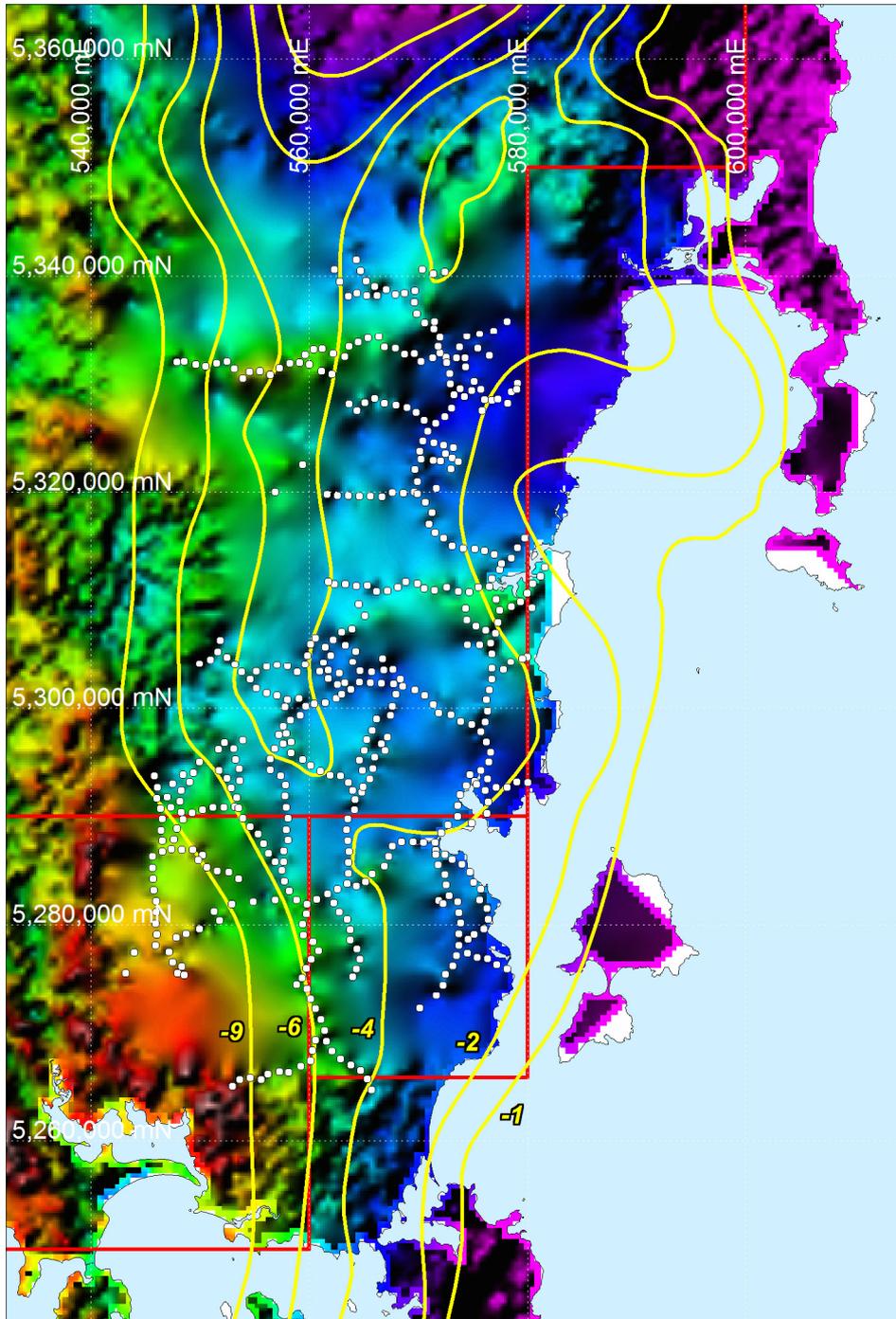


Figure 6: Results of the 2007 KUTh gravity data acquisition program in south east Tasmania. MANTLE07 residual bouguer anomaly (background), new gravity stations (white dots) and interpreted top to granitoid (yellow contour lines, km ASL as labelled).

3.3.3 Data Processing

Data were processed to produce a tidal corrected set of instrument readings. Longmans' formulae was used for the calculation of tidal changes at the local time and location. The final data set was then processed to account for instrument drift at base, daily drift, and latitude corrections. Data were drift corrected to a base station with a recorded AGSO

Isogal65 value and were derived by the standard AGSO Isogal65 formulae. Terrain corrections were undertaken using a single Bouguer density of 2.67 gms/cc and were completed by consultant Dr. David Leaman.

Data from this gravity survey were forwarded directly to Mineral Resources Tasmania immediately after acquisition and are already on Open File and available via the MRT web site.

3.3.4 Data interpretation

Gravity data were passed to Dr David Leaman who incorporated them into the wider Tasmanian data set. Data were used to produce a refined version of the gravity source model of Leaman & Richardson (1989) MANTLE07. Depth to top granite was then estimated following the method of Leaman & Richardson (2003) by subtracting the deep crustal effects and modelling the resultant gravity field. The results of Dr Leaman's work are summarised in Figure 6 and provided in full in Appendix 9.

Results of this work, combined with the previous work of Leaman & Richardson (2003) indicate that depth to top granitoid is likely to be >5km in the surrender areas to the north and south of SEL 26/2005.

4 Conclusion and Recommendations

The combined results of work completed to date indicate that the geothermal prospectivity of the surrendered areas is low. Whilst MT data indicate the presence of a significant conductivity anomaly in the crust in the northern section, heat flow values observed here and in the south are both relatively low. Likewise, gravity data interpretation in both northern and southern areas suggests that underlying granite bodies, if present, are likely to be deep seated (>5km depth). Consequently, the potential for exploitable EGS plays in these areas is considered to be small. This being the case, it is recommended that areas totalling ca.5000km² of SEL 26/2005 be surrendered. A map detailing the proposed partial surrender is presented in Figure 7.

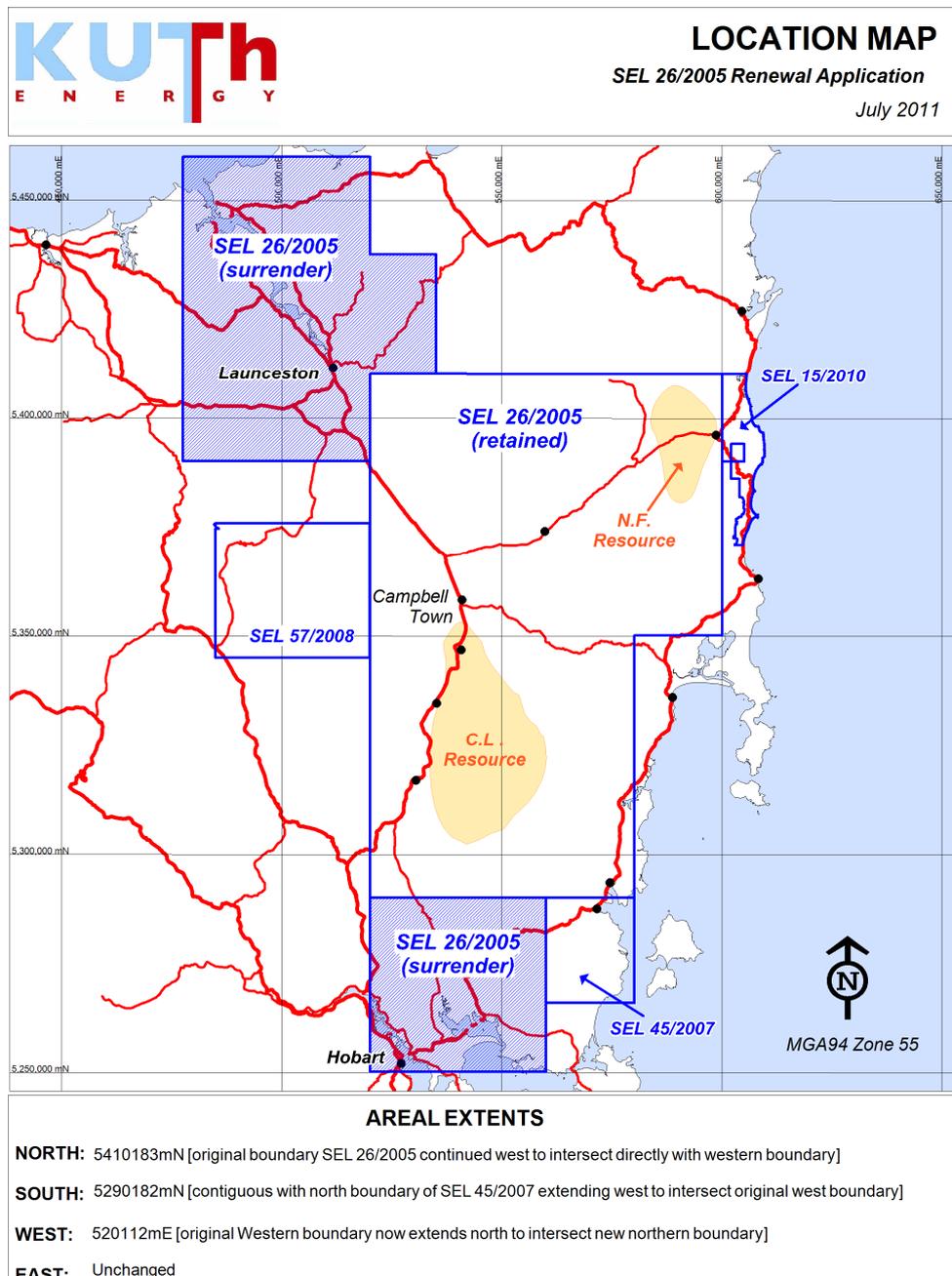


Figure 7: Map of proposed partial surrender of SEL 26/2005.

5 Environment

5.1 Drilling rehabilitation

Drill pads were rehabilitated progressively throughout 2008 – 2009 and this work is considered to be complete. Drill sumps were filled using the stockpiled soil with the original topsoil replaced and seeded as the final layer. Landowners were consulted post-rehabilitation to ensure their satisfaction. Photographs before and after drilling are included in Appendix 10.

6 References

- Burrett, C.F. and Martin, E.L.: Geology and Mineral Resources of Tasmania, *Special Publication Geological Society of Australia*, **15**, (1989).
- Collins, P.L.F., Wyatt, B.W. and Yeates, A.N.: A gamma ray spectrometer and magnetic susceptibility survey of Tasmanian granitoids, *MRT unpublished report 1981/41*, (1981).
- Cull, J.P.: Heat Flow and Regional Geophysics in Australia, *in Terrestrial Heat Flow and the Lithosphere Structure*, Cermak, V. and Rybach, L. (Eds), Springer-Verlag, (1991), 486-500.
- Hermanto, M.R.: Magnetotelluric Investigations of the Tamar Lineament, University of Tasmania, PhD Thesis, *unpublished*, (1990).
- Leaman, D.E. and Richardson, R.G.: A Geophysical Model of the Major Tasmanian Granitoids, *Tasmanian Geological Survey Record*, 2003/11, (2003).
- Powell, C. McA. and Baillie, P.W.: Tectonic Affinity of the Mathinna Group in the Lachlan Fold Belt, *Tectonophysics*, **214**, (1992), 193-209.
- Reed, A.R.: Pre-Tabberabberan Deformation in Eastern Tasmania: a Southern Extension of the Benambran Orogeny, *Australian Journal of Earth Sciences*, **48**, (2001), 785-796.

7 Keywords

Geothermal exploration
 HDR (Hot Dry Rock)
 HFR (Hot Fractured Rock)
 EGS (Enhanced Geothermal System)
 High Heat Producing (HHP) granite
 Tamar Conductivity Zone (TCZ)
 Magnetotelluric
 Aeromagnetic
 Thermal conductivity
 Thermal gradient
 Surface heat flow
 Shallow grid drilling
 Deep drilling
 Inferred Resource