Power down under

Annual Report 2010

SEL 26/2005 (Fourth Annual Report)
& SEL 45/2007 (Third Annual Report)
8th July 2009 to the 7th July 2010

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KUTh ENERGY

Summary

KUTh Exploration Pty Ltd (KUTh) currently holds three Special Exploration Licences and one licence application 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 combined annual report covers work completed in the year 8/7/2009 – 7/7/2010 on tenements SEL 26/2005 and SEL 45/2007. This is the fourth Annual Report lodged for SEL 26/2005, which was granted on 7/8/2006 and the third for SEL 45/2007 which was granted on 19/12/2007. Both tenements are located in the eastern half of Tasmania and cover a combined area of 14,171 km^2.

Work commenced and/or completed on the tenements in this period includes:

- *Completion of a major reconnaissance magnetotelluric (MT) survey across the Midlands area in May-August 2009.*
- *Structural interpretation of aeromagnetic data collected in the Midlands area in 2009.*
- *Completion of an infill MT survey in the Midlands in February-March 2010.*
- *Acquisition of 626 infill gravity data stations throughout the Midlands in April-May 2010.*
- *Commencement of the full-scale passive ambient seismic tomographic (ASET) project in the Tunbridge area by Dr Anya Reading of the University of Tasmania (UTAS).*
- *Completion of a review of the existing Tasmanian legacy seismic data holdings (UTAS collaboration)*
- *3D geothermal modelling of the Fingal area to produce an Inferred Geothermal Resource (contained heat) estimation.*

Work completed focuses upon target areas in the Midlands (Charlton-Lemont) and Fingal (Mt Nicholas-Fingal). Results from successive MT surveys at the Charlton-Lemont (CL) resource (260,000PJ$_{th}$) indicate the presence of major electrically conductive features coinciding with fracture zones and heat flow anomalies and may imply permeability at depth. 3D geothermal modelling of the Mt Nicholas-Fingal (NF) area in SEL 26/2005 infers a contained heat resource of around 101,000PJ$_{th}$ within a 384km^3 granitic reservoir at 3 – 5km depth. This resource is considered to represent a potentially viable granite-hosted Hot Dry Rock target.

Future work planned for SEL 26/2005 and 45/2007 includes:

- *Gravity modelling (2D/3D) at the CL resource*
- *Stress modelling work at CL*
- *Seismic risk studies of eastern Tasmania and resource areas*
- *Acquisition of additional rock property data from the Upper Parmeener Unit at NF*
- *Data compilation, drill targeting and prioritisation at CL and NF*
- *Evaluation of potential deep slim-line drilling rig options*
- *Drill planning and engineering, permitting and site preparation*
- *Drilling and evaluation of an 'intermediate' depth slim-line bore hole (2-3km) on SEL 26/2005.*
- *Sponsorship of an Honours project to acquire and assess geophysical data to better define the geothermal anomaly observed in the Rheban area (SEL 45/2007).*

Planning for deep drilling on SEL 26/2005 remains ongoing. At present it is anticipated that, at earliest, drilling of this tenement would commence in 2011.

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1 Introduction

KUTh Exploration Pty Ltd (KUTh) is a geothermal explorer based in Hobart, Tasmania, and is the holder of three current geothermal exploration licences and one licence application 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. Whilst the primary goal of this work is to produce electrical energy, the company also maintains an interest in both cascading and direct-use applications for geothermal energy.

This combined annual report covers work completed in the period 8/7/2009 – 7/7/2010 on KUTh's tenements SEL 26/2005 and SEL 45/2007. This is the fourth Annual Report lodged for SEL 26/2005, and the third for SEL 45/2007.

1.1 Tenement Status

KUTh Exploration Pty Ltd (KUTh) is a subsidiary of KUTh Energy Ltd and is the sole holder and operator of SELs 26/2005, 45/2007 and 57/2008 (Figure 1). All three tenements are granted for periods of five years to search for geothermal substances (Category Type 6). A fourth licence, SEL 15/2010 remains under application. Tenure details of SEL 26/2005 and SEL 45/2007 are provided in Table 1. SEL 57/2008 was granted in May 2009 and is reported independently of the older tenements.

Tenement Type	SEL	SEL
Number	26/2005	45/2007
Commodity	Geothermal	Geothermal
Licensee	KUTh Exploration P/L	KUTh Exploration P/L
Operator	KUTh Exploration P/L	KUTh Exploration P/L
Area	12,360km^2	1,811km^2
Date Granted	7/08/2006	19/12/2007
Renewal	07/08/2011	19/12/2012

Table 1: Tenure details for SEL 26/2005 and SEL 45/2007.

1.2 Location and access

SEL 26/2005 and SEL 45/2007 combined include 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 SEL 26/2005 includes metropolitan Hobart and Launceston. A number of highways traverse the area and provide access along with minor roads, farm and forestry tracks. Numerous areas are excluded from both SEL 26/2005 and 45/2007, including National Parks, Commonwealth land, a gas pipeline easement and various small historic and other features.

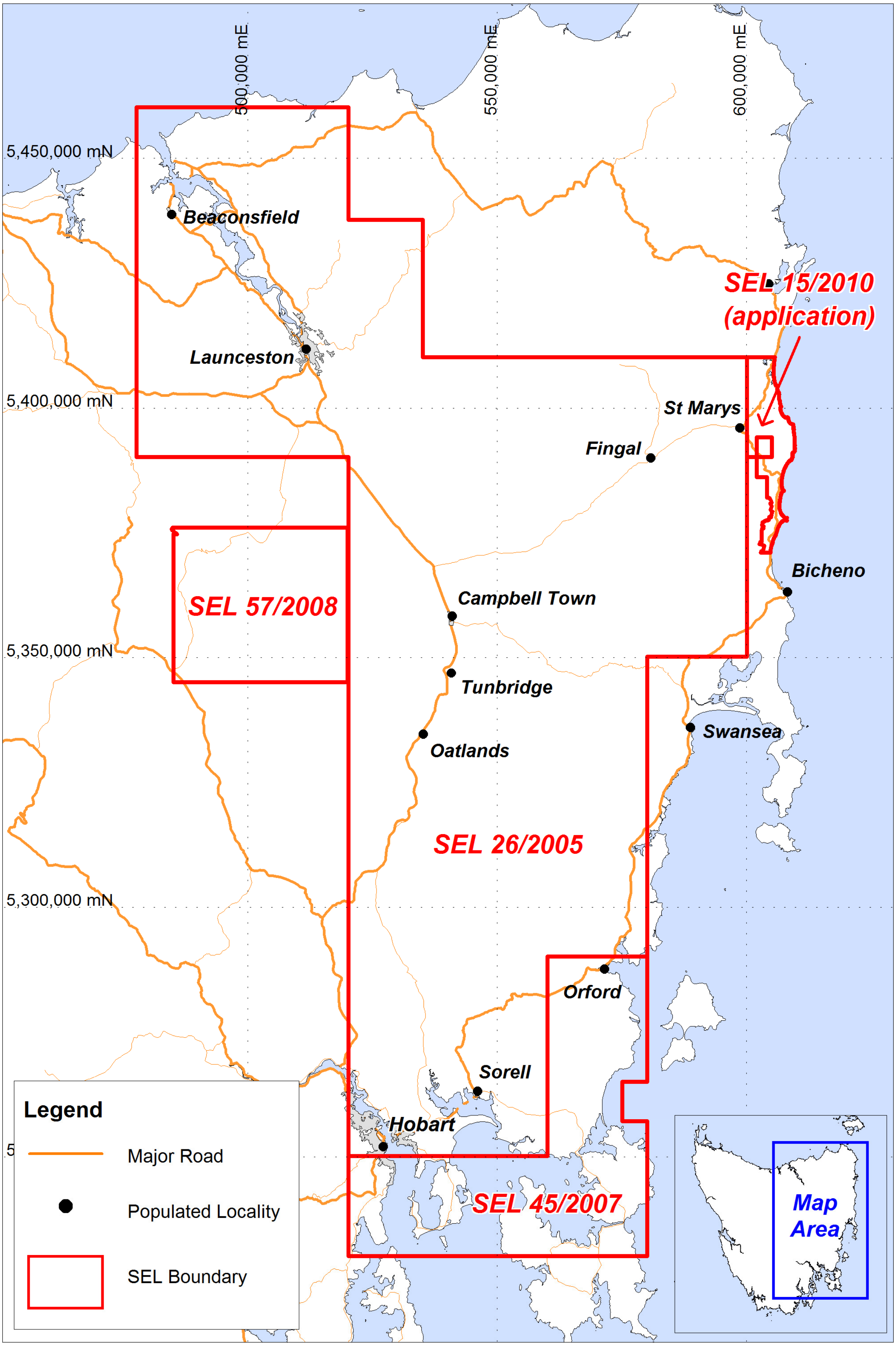

Figure 1: Location map of KUTh Energy Geothermal Special Exploration Licences in Tasmania. (Note this map does not indicate internally excluded areas).

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.

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).

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 initially 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 μW/m^3 for granites at the Royal George Mine.

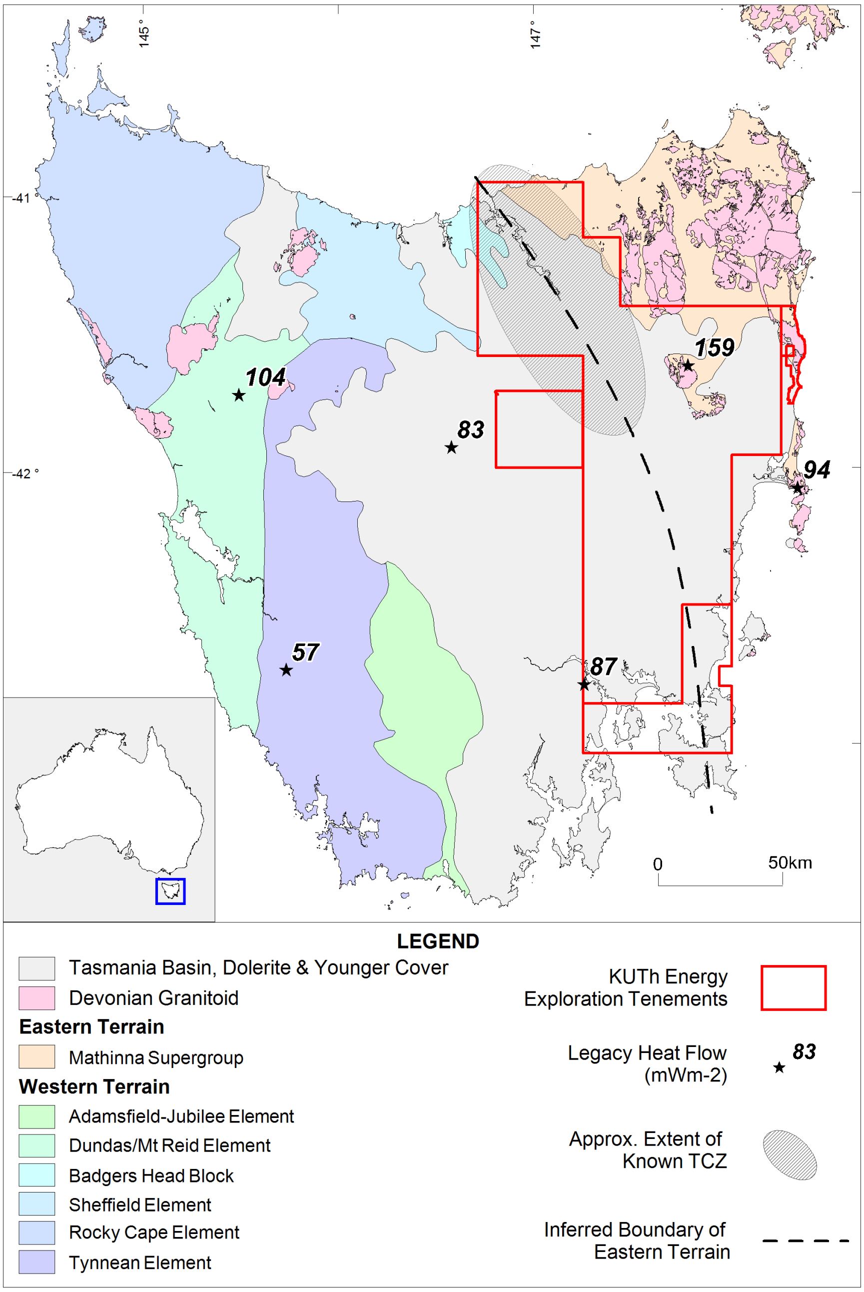

Figure 2: Regional geology of Tasmania showing the major crustal elements. Legacy heat flow data are as summarised by Cull (1991). Also shown is the approximate extent of the known TCZ prior to recent MT survey work.

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 Storeys 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 historic 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 (Ward *et al.*, 2008). Data derived from this work, which was completed in March 2007, was provided to Dr David Leaman who used it to update the Tasmanian mantle source model of Leaman and Richardson (2003). This updated model was then used to refine predicted depth to top granite (Figure 3).

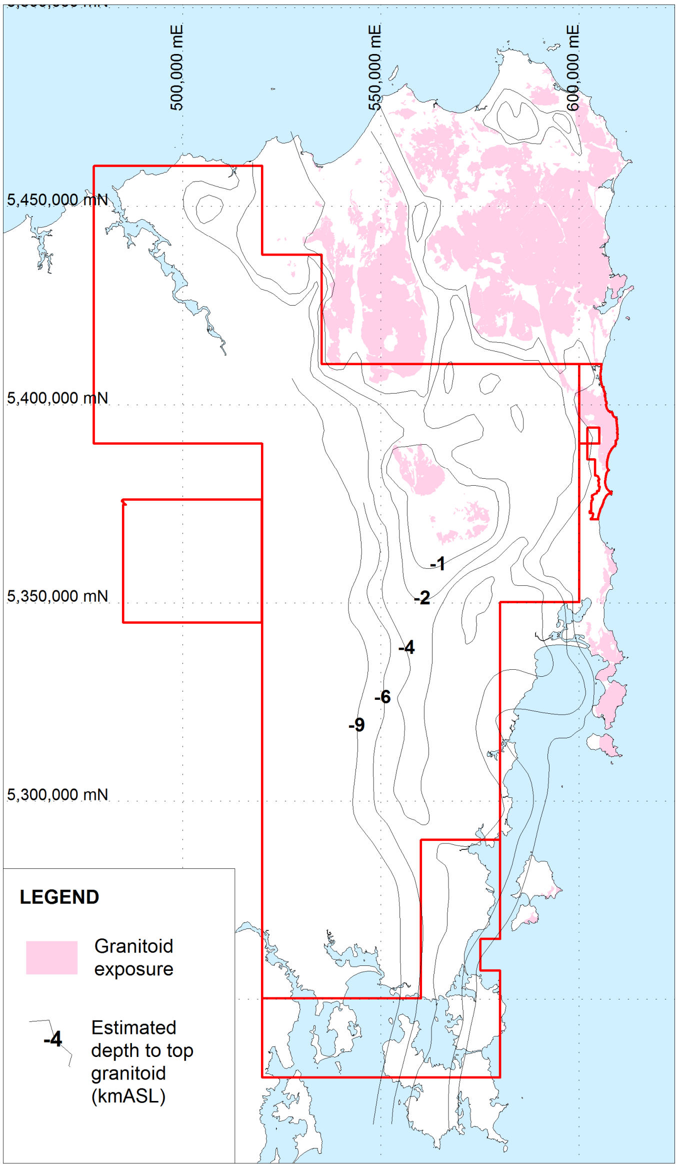

Figure 3: Map of granite outcrop with predicted depth (km above sea level) to top granitoid contours as interpreted by Leaman (2008).

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 was 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).

In 2007 – 2009 KUTh energy undertook a program of shallow drilling to enable systematic estimation of surface heat flow across the tenement area (Figure 4; Goh & Holgate, 2009). This work resulted in the identification of several significant thermal anomalies (where heat flow is >90mWm^{-2}) that display a good spatial correlation with the predicted location of buried granite (Figure 3 & 4). The largest observed anomaly extends ~4000km^2 across the central portion of SEL 26/2005 and includes three zones of very high heat flow (>100mWm^{-2}) at Charlton-Lemont and Macquarie in the Midlands and at Mt Nicholas-Fingal in the far north-east. The largest and strongest of these thermal anomalies is that observed at Charlton-Lemont.

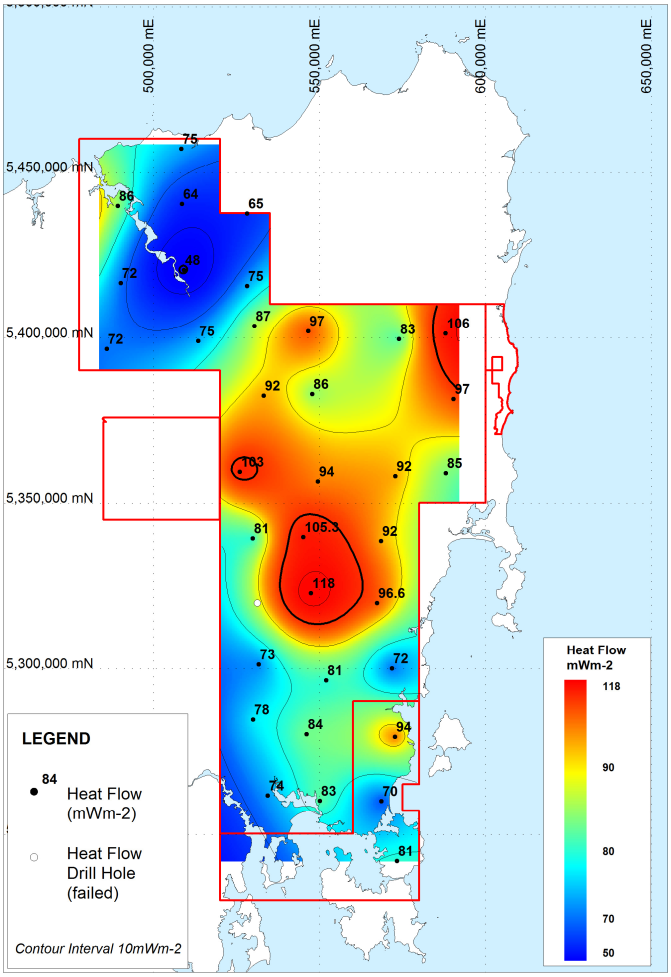

Figure 4: Results of KUTh Energy shallow heat flow drilling program across SEL 26/2005 and SEL 45/2007.

Three-dimensional (3D) conductive thermal modelling of the Charlton-Lemont area was subsequently undertaken in 2009 using a combination of legacy and new acquired geological and geophysical data. The results of this work (reported in Goh & Holgate 2009) inferred a contained heat resource of around 260,000PJ within a 1019km^3 reservoir located between 3 – 5km depth in the Charlton–Lemont area (Figure 5). Temperatures predicted within the resource are up 200°C at 5km depth. Geothermal Plays initially identified at Charlton-Lemont included a granite-related Hot Dry Rock target in the east and a less well defined but slightly hotter target in the west. Significantly, the conductive model inversion was found to be unable to account for the presence of extreme heat flow values in the western resource areas without the addition of a previously unrecognised geological unit. A non-unique conductive solution comprising an additional body of rock of either high heat production or high thermal conductivity (termed 'Unit A') was required in this area to enable model fit. This Unit may represent a previously unrecognised lithology (e.g. granitoid) or structure (highly foliated sediment). Alternatively, the additional heat flow into the western resource area could be the result of the advective movement of heat by fluids along localised permeable pathways.

Also completed in 2008/2009 was the acquisition of new magnetotelluric data along two east – west profiles in the far north and central Midlands areas of SEL 26/2005 (Ward *et al.*, 2008; Goh & Holgate 2009). Results of this work, which was designed to confirm the nature and location of the feature known as the Tamar Conductivity Zone (TCZ), are presented as 2D models in Figure 6. Large east and west-dipping electrically-conductive basement features consistent with the known characteristics of the TCZ were successfully identified in the northern section line. Significantly, an equivalent east-dipping electrically conductive structure was also observed towards the western end of the southern line. This feature, which is interpreted as an extension of that observed in the northern line, indicates the presence of the TCZ within the northern Midlands area. Its presence, open along strike immediately to the north of the high heat flow anomalies at Charlton-Lemont is of considerable interest given the existing interpretation of this feature as a geophysical signature of fluid-bearing fracture-permeable rock.

To further evaluate the extension of the TCZ feature into the resource area, a second more extensive MT data acquisition program was subsequently commenced in 2009. The results of this work, which remained ongoing at the time of reporting in 2009, are reported in full in the following sections.

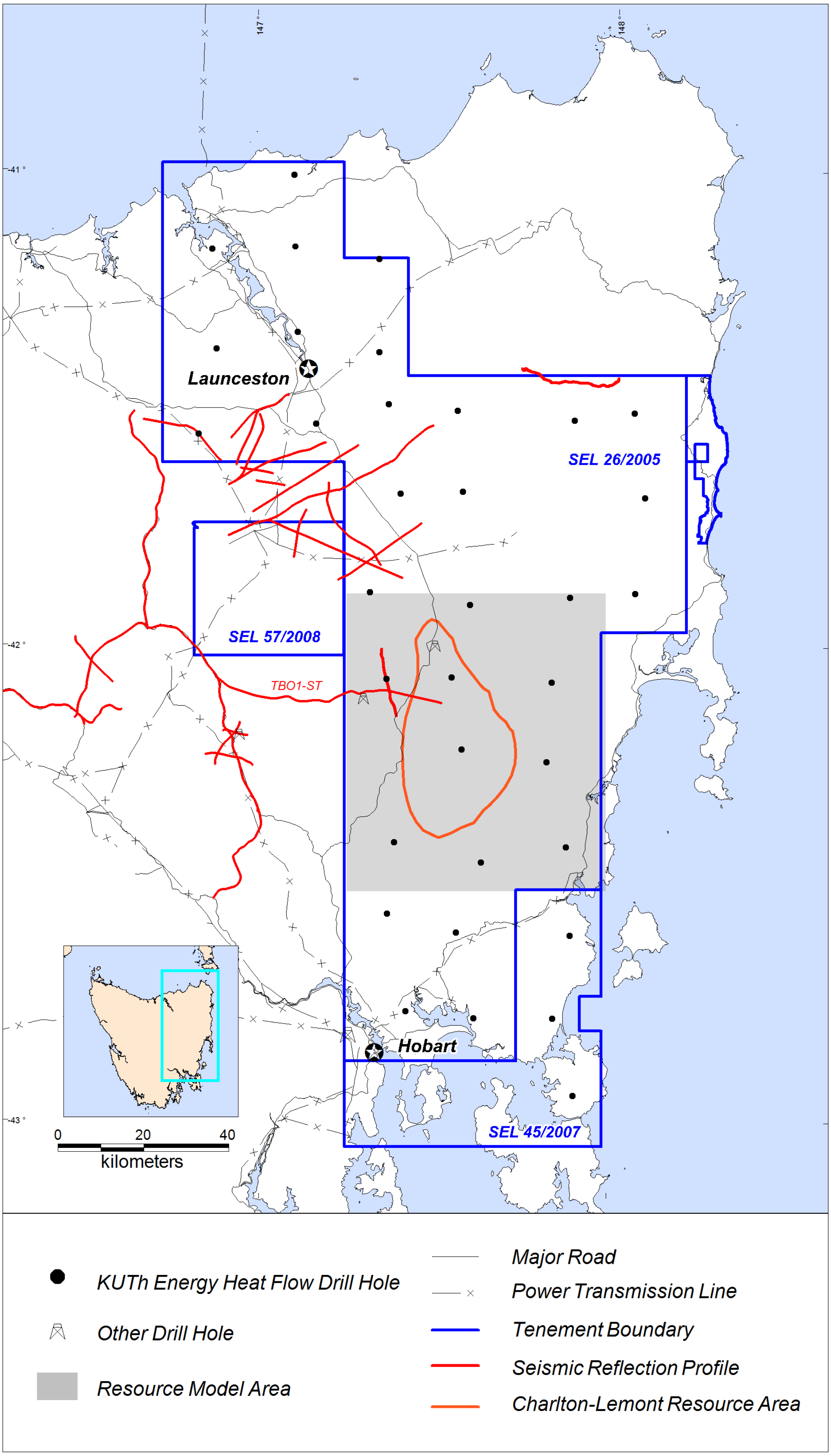

Figure 5: Location of the Charlton-Lemont Inferred Geothermal resource area (orange) showing the extent of 3D earth model (grey) and location of geological data (wells, drill holes) which were used in the construction of the model. For more details refer to Goh & Holgate, 2009.

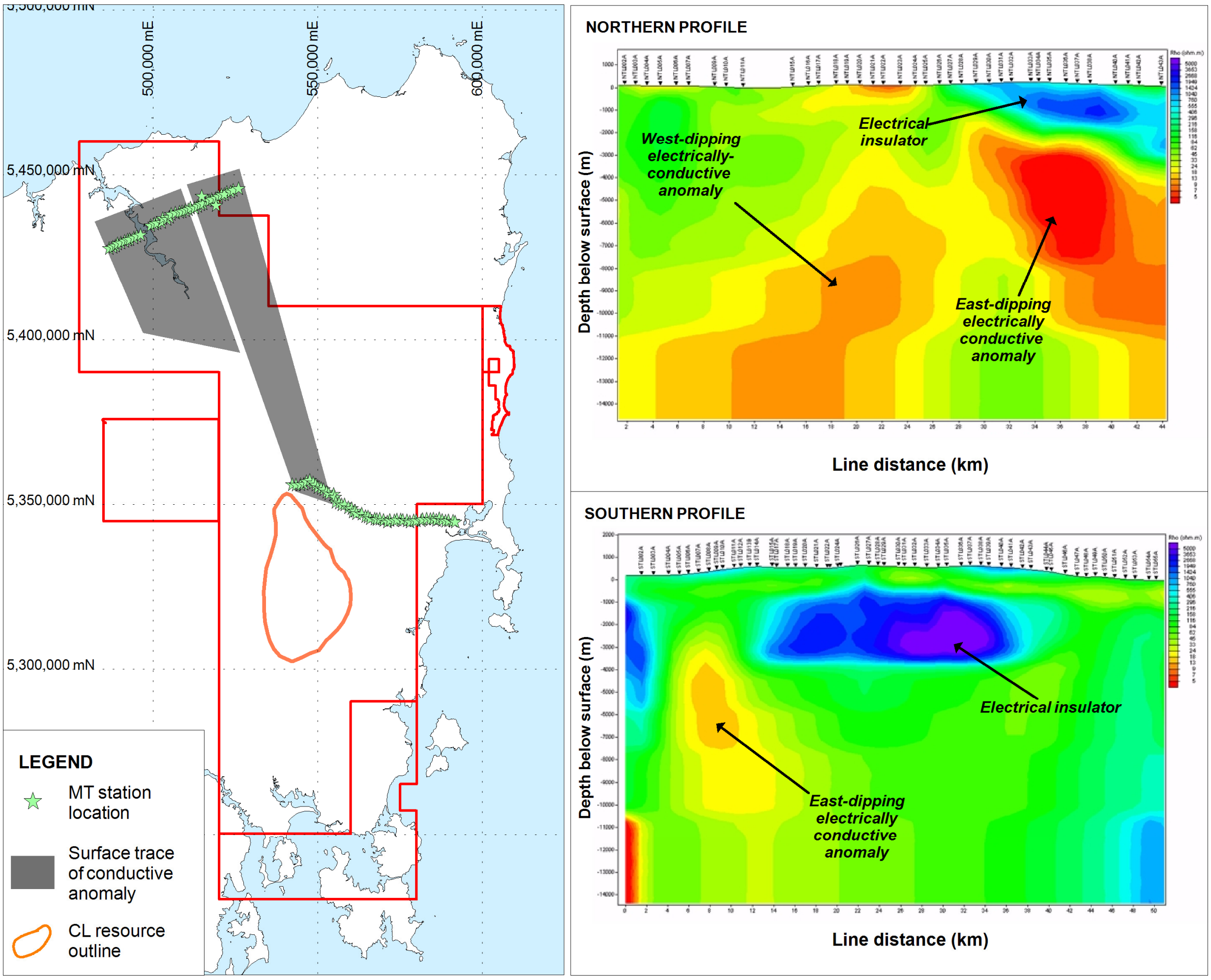

Figure 6: 2008 MT survey station locations (left) and 2D modelled profile results for northern (right, top) and southern lines (right, bottom). Models are inversions of TM and TE shifted data. Resistivity is range 5ohm.m (red) to 6000ohm.m (purple), maximum depth below surface is 14km, station spacings are ~1km, line distance northern line = 44km, southern line = 50km. For further information refer to Goh & Holgate, 2009.

3 Work Completed

Work detailed in this section was undertaken on SEL 26/2005 and SEL 45/2007 during the 12 month period between July 2009 and July 2010. Geophysical work completed or underway during this period included MT and gravity data acquisition and aeromagnetic interpretation. 3D geothermal modelling and resource analysis were undertaken across the Fingal area in early 2010. An appraisal of Tasmanian legacy seismic data, seismic data acquisition underway as part of the ARC-linkage ASET project and determination of an earthquake focal mechanism from ASET data are detailed separately as part the Research & Collaboration section below.

3.1 Magnetotelluric (MT) surveys

An expanded MT/TerraTEM survey was undertaken across SEL 26/2005 in May - August 2009 and was followed by a third program of infill MT data acquisition in February – March 2010. The aim of this work was to investigate the apparent extension of the TCZ into central Tasmania as suggested by the 2008 reconnaissance MT survey. According to these results, the TCZ remained open to the south of Campbell Town directly along strike to the north of the area of anomalously high surface heat flow at Charlton-Lemont (Figure 6). Any extension of the TCZ into the resource area would be thermally significant as it may imply the existence of fracture permeability and naturally occurring fluids at depth.

Data acquisition on the expanded array was designed to enable 3D MT modelling across the central Midlands area and commenced in 2009 with the collection of 158 new stations arranged along three profile lines and a surrounding wide-spaced grid. The results of this work were processed using 3D inversion modelling by WesternGeco EM (Geosystem) and were returned in October 2009. These data clearly indicated the presence of the TCZ within the resource area. Unexpectedly, the electrically conductive zone was observed to diverge in strike from NW/SE to EW immediately beneath the resource area. To further constrain the location and shape of the newly identified anomalies, and to enable the confident generation of drilling targets based upon these, a further program of infill MT was subsequently undertaken in early 2010. A total of 43 additional stations were collected on a 2 - 4 km spaced grid located in and around the 2008/2009 data array. Results of this work were subsequently incorporated into the existing 3D model which was reprocessed to produce an improved map of the TCZ within the Charlton-Lemont area. The results of this work were returned in May 2010.

3.1.1 MT 2009

The observation of apparent 3D effects along the southern line of the 2008 MT survey indicated that to investigate this area further, and to correctly delineate any southern extension of the TCZ, a more detailed 3D MT array was required (Goh & Holgate, 2009). To achieve this, a second MT survey was undertaken in 2009 with the aim of expanding the 2008 MT into the southern Midlands area. To further ensure that any potential static shift errors were accounted for in subsequent 3D MT models a complimentary program of TDEM data acquisition was undertaken at each MT station location.

Location and Planning

A total of 158 new MT stations were recorded in an array of profile lines and wider-spaced points that built west and south from the existing 2008 Southern MT profile (Figure 7). Stations were located along two NNE trending profiles, NSA and NSB, extending ~50km south of and orthogonal to the 2008 line. A third profile line, EWA, extended the original 2008 profile WNW by around 34km. The far western end of EWA crossed onto SEL

57/2008, the third geothermal tenement held by KUTh in Tasmania. Station spacing along the profile lines was ~1km with a wider spaced array of ~5km located around the main lines and to the north of the original southern line. Geology beneath the lines varied from mainly dolerite in the east to dolerite and/or Permo-Triassic and/or Tertiary sediments in the west and south. A full list of all 2009 MT stations and their locations is provided in Appendix 1.

TDEM data acquisition was attempted at the majority of new MT sites as well as most sites on the 2008 Southern profile. A total of 187 individual site soundings were recorded. MT sites for which TDEM data were acquired are identified in Appendix 1.

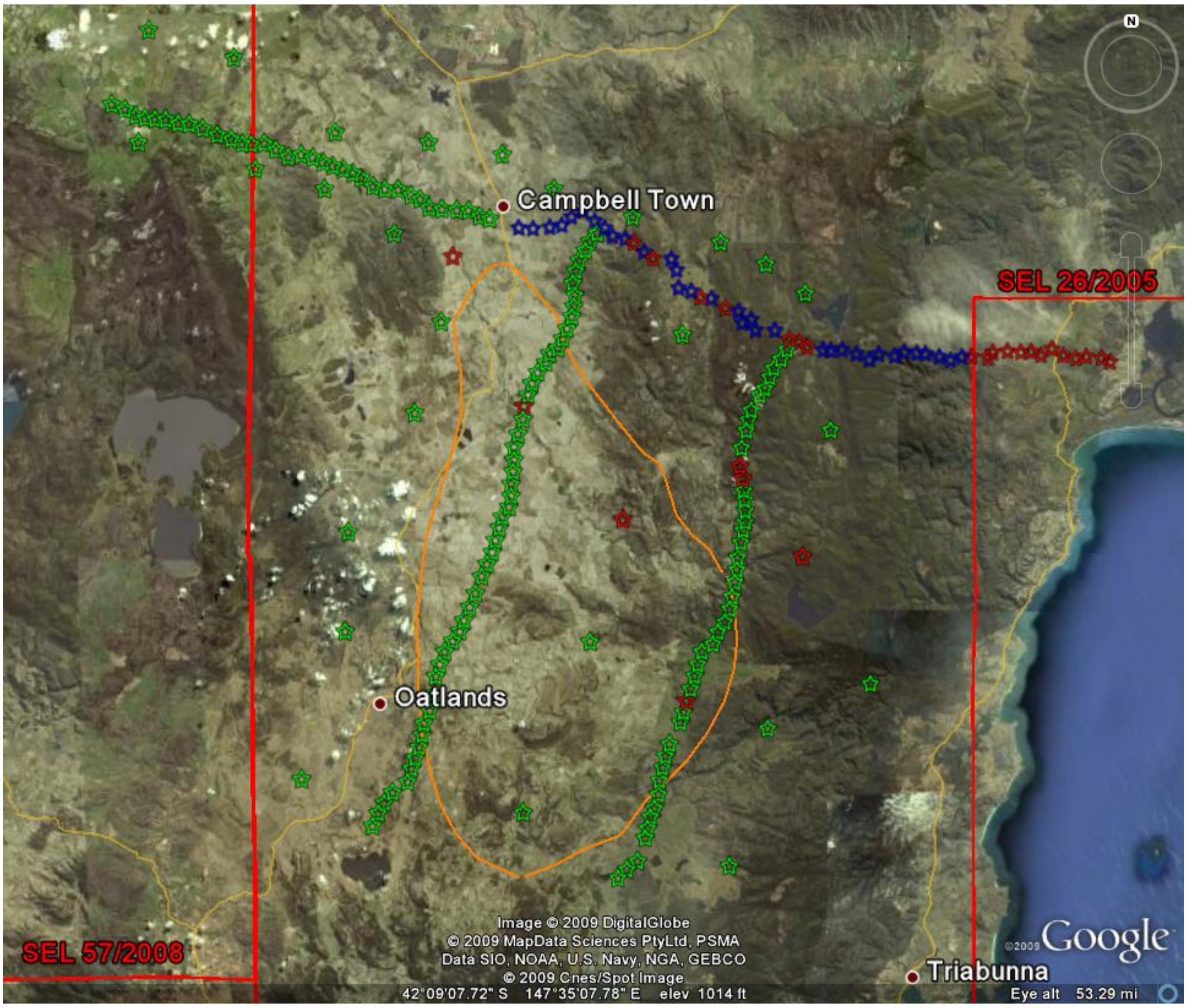

Figure 7: Location map of the 2009 3D MT/TDEM survey array across KUTh Energy's Tasmanian tenements. Green stars represent new (2009) MT and TDEM stations, blue existing (2008) MT stations for which TDEM data has now been collected and red all MT stations (2008 & 2009) for which TDEM data were not collected. The orange outline in the central tenement area indicates the surface extent of the Charlton-Lemont Inferred Geothermal Resource. [Note: boundaries of SEL 57/2008 correct as at time of survey. Background Image ©Google Earth].

Data Acquisition

MT data were acquired by Moombarriga Geosciences using Phoenix MTU-5A data recorders and MTC-50 induction coil systems over a three month period from May to July 2009. Full tensor data collection was attempted at every site although digging difficulties in hard and rocky ground prevented collection of Hz at ~50% of locations. Stations were left in the ground for ~16 hours to ensure resolution of apparent resistivity and phase data in the range 300 – 0.01Hz. MT data at most sites were augmented by the addition of Time Domain Electro-Magnetic (TDEM) data recorded on an Alpha Geoscience TerraTEM system. Whilst it was originally intended that MT and TDEM data be collected concurrently, instrument problems ultimately resulted in the TDEM work being conducted subsequent to the MT survey. The TerraTEM survey was thus largely undertaken in the period July - August 2009. In both cases (MT and TDEM) survey work was significantly impacted by high rainfall and subsequent flooding in the Midlands during June – August 2009. The adverse weather conditions resulted in significant program delays and in some cases prevented access to sites. This was particularly acute in the later TerraTEM survey where a small number of MT stations were unable to be re-accessed for TDEM soundings.

MT data quality was found to be quite variable with a generally low signal due to the survey timing (during the 11-year cyclical sunspot low) and the occasional presence of electrical noise from cultural or natural sources. TDEM data quality was generally fair with smooth decay curves typically obtained out to ~3msec. Occasional poor TDEM data quality was found to be spatially associated with outcropping dolerite, most likely resulting from the highly resistive nature of these rocks.

Field data processing of MT data was undertaken by Moombarriga Geosciences and included the conversion of time series data to apparent resistivity and phase curves using Phoenix propriety software. Full details of the MT/TDEM program data acquisition, field processing and results are included in the MT Survey Report (Appendix 1).

Modelling and Interpretation

Data derived from the 2009 MT survey were combined with 41 MT stations from the existing 2008 survey to form an array suitable for 3D inversion modelling. This work was undertaken by contractors WesternGeco EM (Geosystem), based in Milan, Italy, using their proprietary WinGLink® software built upon the code described by Mackie and Madden (1993). Overall, data quality from the combined surveys was found to be good. Modelling was undertaken as an inversion process involving the initial computation of a forward (predicted) response followed by an iterative process of comparison and modification based upon the differences between the predicted and observed data. Two sets of 3D inversion models were run, a fine mesh using all available MT stations and a coarser mesh using an approximately evenly-spaced subset of 62 sites. Parameters for the fine model (considered to represent the final result) are summarised in Table 2. The consistency between major features identified in the fine and coarse spaced models was considered to be good.

Cumulative Iterations	50
RMS	2.398
tau	3
lnZ_{xy} amplitude, error floor	3%
lnZ_{xy} phase, error floor	3%
Tipper error floor	0.02
Regularisation	Laplacian
Mesh orientation	-16°
Cell number (xyz)	121, 99, 112
Minimum cell dimension (xyz)	800,800,30
No. Sites	196
No. Frequencies	21
No. Frequencies/decade	4
Minimum Frequency	0.003
Maximum Frequency	300

Table 2: Specifications of the final 2009 3D MT model array (fine mesh)

The modelling was not constrained by any assumptions regarding the nature of the geology in this area. Static shift factors were successfully accounted for by application of near surface topography and structure in the 3D inversion models indicating that further collection of TDEM data would not be required for 3D MT surveys. A full report detailing the results of the modelling process is included in Appendix 2.

A selection of results of the MT modelling, presented as section and plan 'slices' from the 3D model, are provided in Figure 8. The results confirm the southward extension of the TCZ as a basement feature beneath the Charlton-Lemont resource area. Visible as a strong electrically-conductive zone (red), the new data indicate that the TCZ undergoes a major shift in orientation from NS to EW within the model area exhibiting an arcuate trend when displayed in horizontal or plan view. Vertical sections through the E-W striking section of this feature reveal that it comprises an inverted v-shaped electrically conductive anomaly. The apogee of this structure is projected to lie beneath the anomalously hot Lemont bore hole (surface heat flow 118mWm^{2}).

Visualised in 3D, the TCZ thus appears to be an east-dipping NW/SE striking planar structure in the NW of the survey area. As this feature diverges to the E/W in the centre of the resource area it appears to become less continuous forming isolated areas of low resistivity that are circular in plan and linear in section. However, as noted by Geosystem in its final report (Appendix 2) 'results are ... most reliable along the profiles (with) poorly controlled detailed structure between leading to a survey footprint on the results'. Anomalies that are predicted to lie between survey lines are inherently less certain than those which spatially coincide with the lines of data. To improve the reliability of the model prediction between profile lines ahead of deep drill targeting it was thus decided to undertake a further program of infill between station lines to increase image resolution away from the profiles to between 2 – 4km.

Modelling of data generated by the 2009 survey was also undertaken independently by Dr Adele Manzella of the *Consiglio Nazionale delle Ricerche-Istituto di Geoscienze e Georisorse* (CNR-IGG) in Italy between October 2009 – February 2010. In this instance, modelling was performed using 2D inversion of TE-TM data along series of ~NS and ~EW profiles. Input data were corrected for static shift errors using the available TDEM data. Horizontal slices of resistivity distribution were obtained by interpolation of the modelled 2D results.

The results of Dr Manzella's work, which are presented in Appendix 3, are generally consistent with those of the 3D inversion modelling and support the conclusions drawn from this work. Differences between the two results are considered by Dr Manzella to most likely to be attributable to the limitations of 2D modelling when compared to full 3D inversion. The most significant variance between the 2D and 3D results is observed in the distribution of conductive anomalies in the far SW of the survey area along profile NSA [Line B Figure 8; Line B-2 Appendix 3]. Here a region of conductive crust is predicted to occur below ~3km in the 2D model. By contrast, the 3D model predicts a similar anomaly at depths below ~4km. It is expected that these differences may be resolved with improvement of the data density between profile lines to be provided by the infill survey.

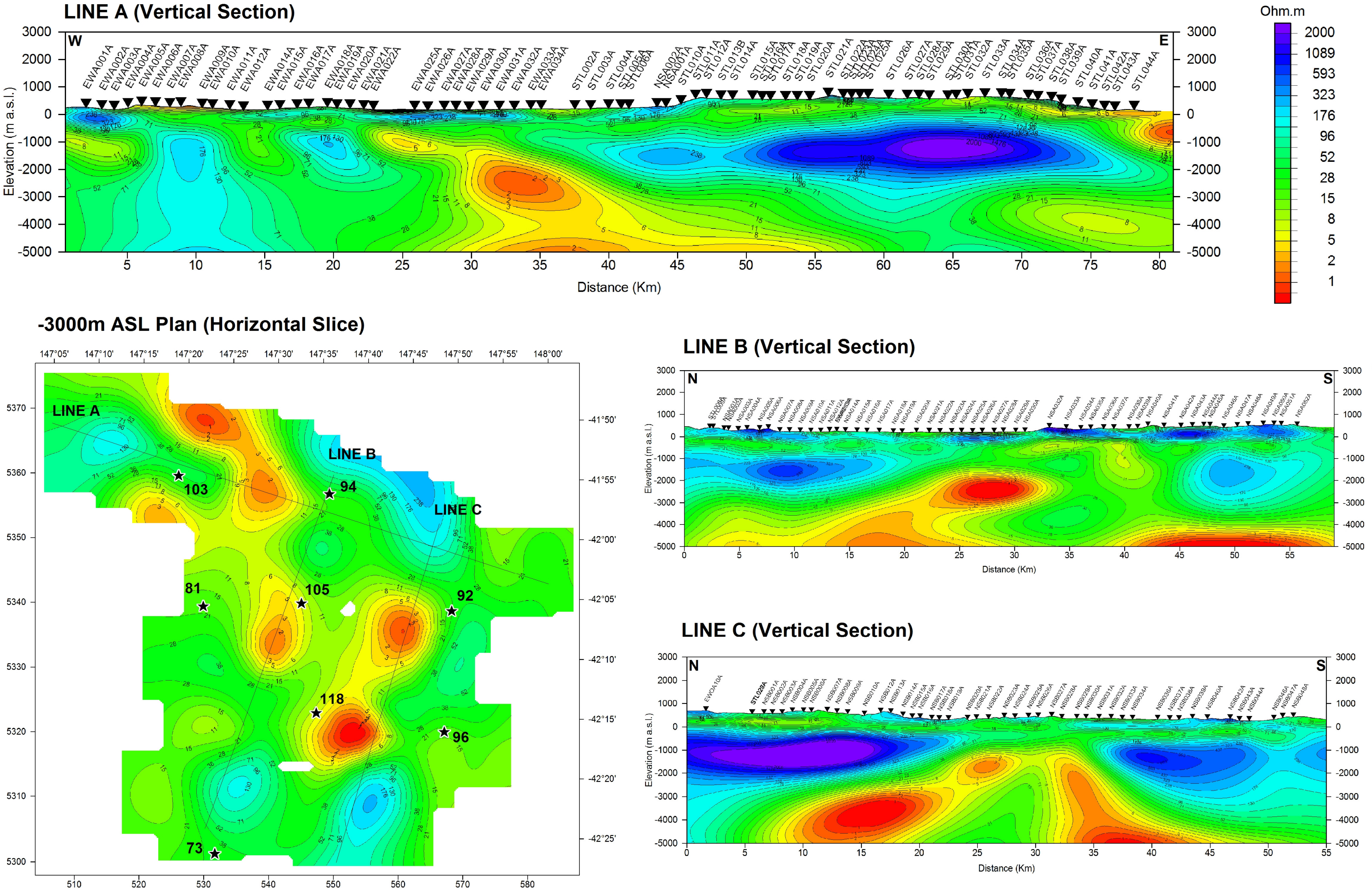

Figure 8: Selected results from the 2009 3D magnetotelluric survey presented as resistivity images. All images share the same scale (shown); warmer colours indicate increased electrical conductivity. Vertical section lines are as located on the -3000m ASL Plan. Vertical exaggeration of these sections is 2:1. The location of surface heat flow values (mWm^{-2}) from KUTh's shallow heat flow program are shown on the plan as black stars. Details of the modelling process are provided in Appendix 2.

3.1.2 MT 2010

The observation of the extended TCZ within the vicinity of the Charlton-Lemont resource implies the presence of fluid-bearing permeable fracture systems and is of great significance to its geothermal prospectivity. An accurate knowledge of the distribution of high and low conductivity zones is thus critical to drill targeting within this region. The variation in the observed strike of the TCZ from NW/SE to E/W within the vicinity of the resource resulted in the prediction of electrically-conductive anomalies in regions of low data density in the 2008/2009 grid. To ensure that these features were adequately resolved to support drill targeting a further program of infill data collection was undertaken across this region in early 2010.

Location and Planning

The 2010 MT grid comprised 43 stations arranged within a ca. 2 – 4km spaced grid in and around the 2008-2009 data array (Figure 9). Station locations were designed to provide maximum coverage across areas of predicted conductive anomalies within the vicinity of the Charlton-Lemont geothermal resource. Geology beneath the lines varied from mainly dolerite in the east to dolerite and/or Permo-Triassic and/or Tertiary sediments in the west and south. A full list of all 2010 MT stations and their locations is provided in Appendix 4.

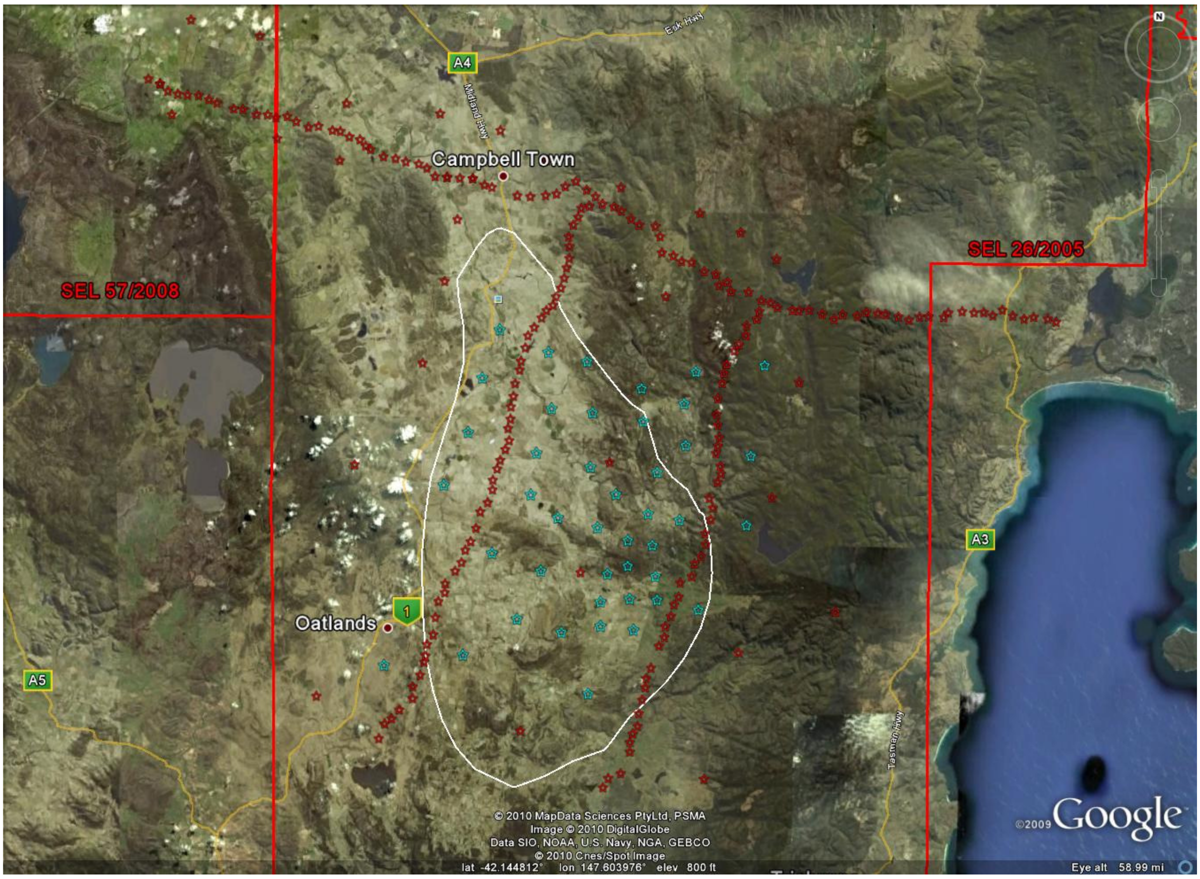

Figure 9: Location map of the 2010 3D MT/TDEM survey array across KUTh Energy's Tasmanian tenements. Blue stars represent new (2010) MT stations, red existing (2008/2009) MT stations. The white outline in the central tenement area indicates the surface extent of the Charlton-Lemont Inferred Geothermal Resource. Background Image ©Google Earth.

Data Acquisition

MT data were acquired by Moombarriga Geosciences using Phoenix MTU-5A data recorders and MTC-50 induction coil systems over a one month period from February to March 2010. Full tensor data collection was attempted at every site although digging difficulties in hard and rocky ground prevented collection of Hz at ~40% locations. Stations were left in the ground for ~16 hours to ensure resolution of apparent resistivity and phase data in the range 300 – 0.01Hz.

MT data quality was generally good with an increase in solar activity resulting in the strongest signal yet recorded in the Tasmanian MT surveys. Occasional noise issues were present and were produced by the various cultural or natural sources encountered in previous surveys.

Field data processing of MT data was undertaken by Moombarriga Geosciences and included the conversion of time series data to apparent resistivity and phase curves using Phoenix propriety software. Full details of the MT program data acquisition, field processing and results are included in the MT Survey Report (Appendix 4).

Modelling and Interpretation

Data derived from the 2010 MT survey were combined with MT stations from the existing 2008/2009 survey to form an array of 238 points suitable for 3D inversion modelling. This work was again undertaken by contractors WesternGeco EM (Geosystem), based in Milan, Italy, using their proprietary WinGLink® software. Overall, data quality from the combined surveys was found to be good with no significant differences observed between the datasets. Modelling was undertaken using an identical inversion process to that employed in 2009. Parameters for the final model result are summarised in Table 3.

Cumulative Iterations	50
RMS	2.525
tau	3
$\ln Z_{xy}$ amplitude, error floor	3%
$\ln Z_{xy}$ phase, error floor	20%
Tipper error floor	0.02
Regularisation	Laplacian
Mesh orientation	-16°
Cell number (xyz)	121, 99, 112
Minimum cell dimension (xyz)	800,800,30
No. Sites	238
No. Frequencies	21
No. Frequencies/decade	4
Minimum Frequency	0.003
Maximum Frequency	300

Table 3: Specifications of the final 2010 3D MT model array

As in 2009, the modelling was not constrained by any assumptions regarding the nature of the geology in this area. Static shift factors were again successfully accounted for by application of near surface topography and structure in the 3D inversion models. A full report detailing the results of the modelling process is included in Appendix 5.

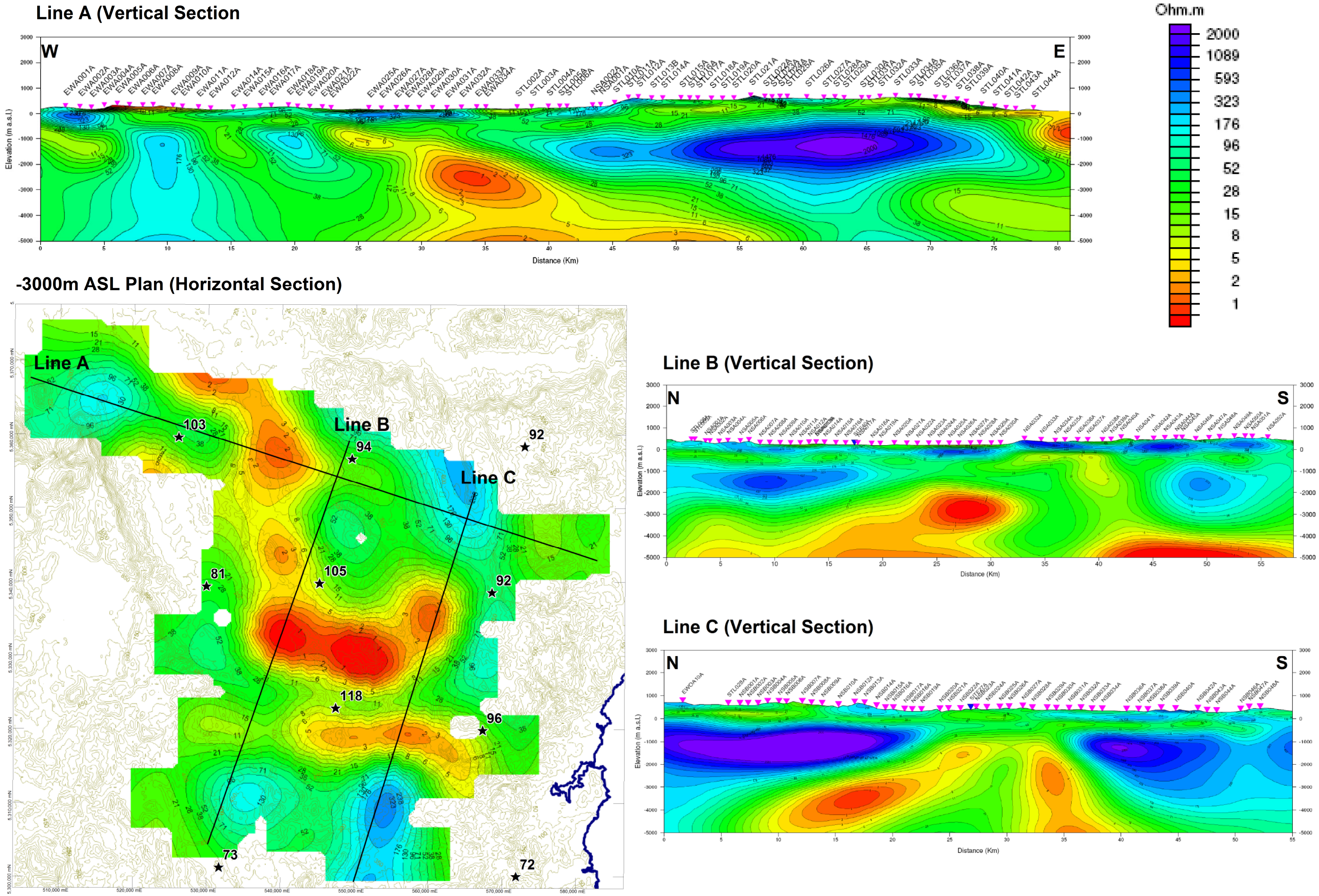

Figure 10: Selected results from the 2010 3D magnetotelluric survey presented as resistivity images. All images share the same scale (shown); warmer colours indicate increased electrical conductivity. Vertical section lines are as located on the -3000m ASL Plan. Vertical exaggeration of these sections is 2:1. The location of surface heat flow values (mWm^{-2}) from KUTh's shallow heat flow program are shown on the plan as black stars. Details of the modelling process are provided in Appendix 5.

A selection of results of the 2010 MT modelling, presented as section and plan 'slices' from the 3D model (comparable to those in Figure 8), are provided in Figure 10. These results confirm the major shift in orientation of the TCZ from NS to EW beneath the model area. The addition of new data has significantly improved the resolution of structure in areas between the 2009 NE/SW profile lines. In particular, features originally modelled as isolated areas of low resistivity are now resolved as strong EW striking structures. Now shown to be of planar geometry, two EW features are observed, a shallowly north-dipping anomaly in the north and a moderately southerly-dipping anomaly in the south. Vertical sections through these features indicate that the inverted v-shaped electrically-conductive anomaly, originally observed on Line NSB only (in the 2009 data) is, in fact, laterally extensive beneath this area. The apogee of this structure is again projected to lie beneath the anomalously hot Lemont bore hole (surface heat flow 118mWm^2).

3.2 Aeromagnetic Interpretation

In March 2009 KUTh acquired a total of ~15,000 line km of aeromagnetic data across the Charlton-Lemont resource, building upon an area of high quality data previously acquired by AGSO in 1999 (Goh & Holgate, 2009). Attempts to produce a spectral magnetic interpretation of these data to unequivocally delineate depth to base dolerite were unsuccessful. However, these data were successfully employed in a qualitative study designed to identify regional structural patterns through image analysis of combined potential field data. Full details of this analysis, which utilised both gravity and magnetic data and was undertaken by Geoforce PL in September-October 2009, are provided in Appendix 6.

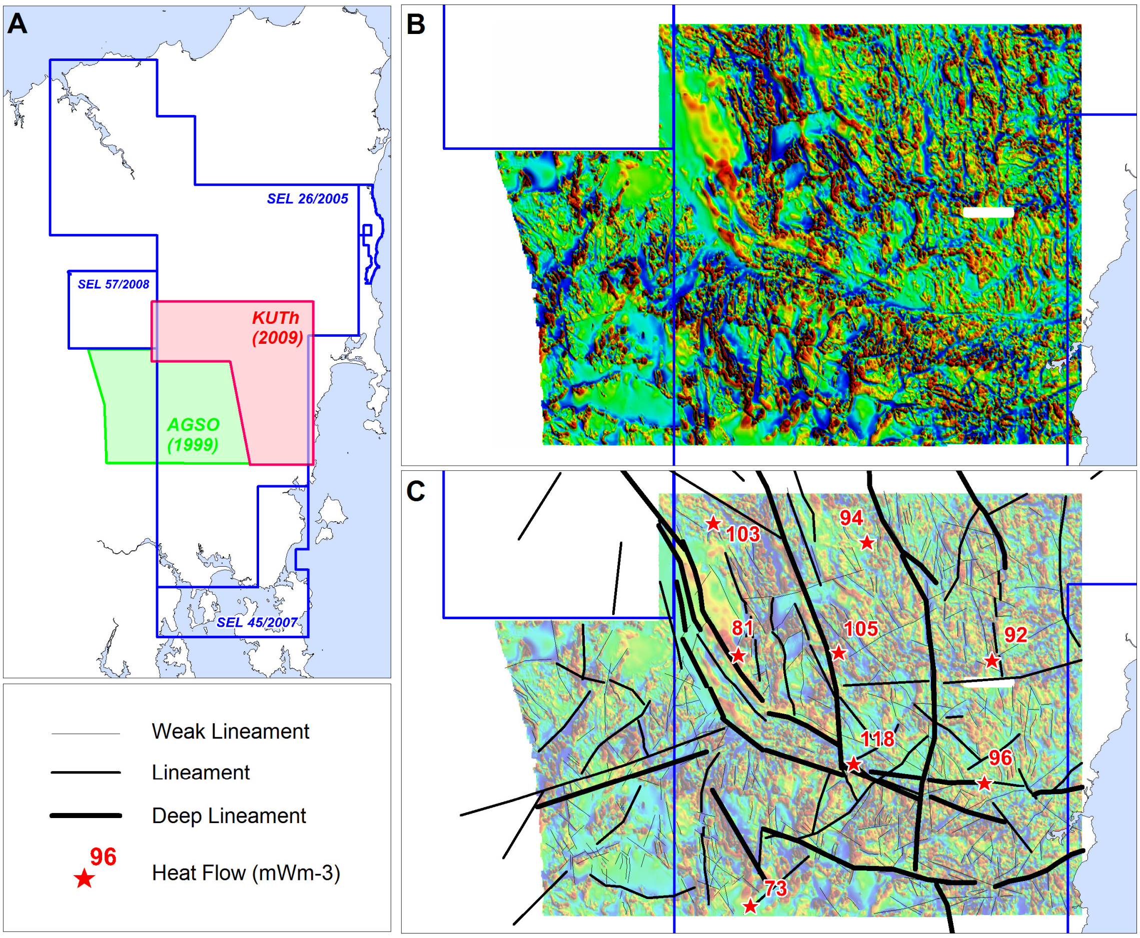

Figure 11: KUTh aeromagnetic data acquisition (a) location plan (b) Reduced-to-pole total magnetic intensity image and (c) interpreted lineaments.

Three categories of lineament were identified from analysis of the potential field data:

1. Weak lineaments: defined as subtle high frequency magnetic fabrics which have limited strike extent, disappear with low-pass filtering and/or upward continuation to >1000m and which are consequently interpreted as shallow surficial structures.

2. Lineaments: defined as clear, extensive and persistent features in the magnetics which generally do not lessen with filtering or upward continuation.

3. Deep crustal lineaments: defined as very strong, extensive and persistent features that are apparent in the regional gravity and in 4000m upward continued magnetics.

The location and distribution of these features is illustrated in Figure 11. The majority of the lineaments identified in the region are interpreted as the signature of fault or fracture systems. Regionally, magnetic structure is dominated by a large, arcuate feature extending from the northwest to the eastern side of the survey area. This feature, which is interpreted to represent a major fracture zone, is also evident in gravity data and digital elevation models (Figure 12). The presence of this trend in both gravity and upward continued magnetic data supports the suggestion that it is a relatively major feature, penetrating to depth in basement. The fact that it is also strongly apparent in the DEM implies that these it is likely to have been subject to reactivation since the Jurassic, most likely as part of the regional Tertiary rifting event observed throughout much of this area.

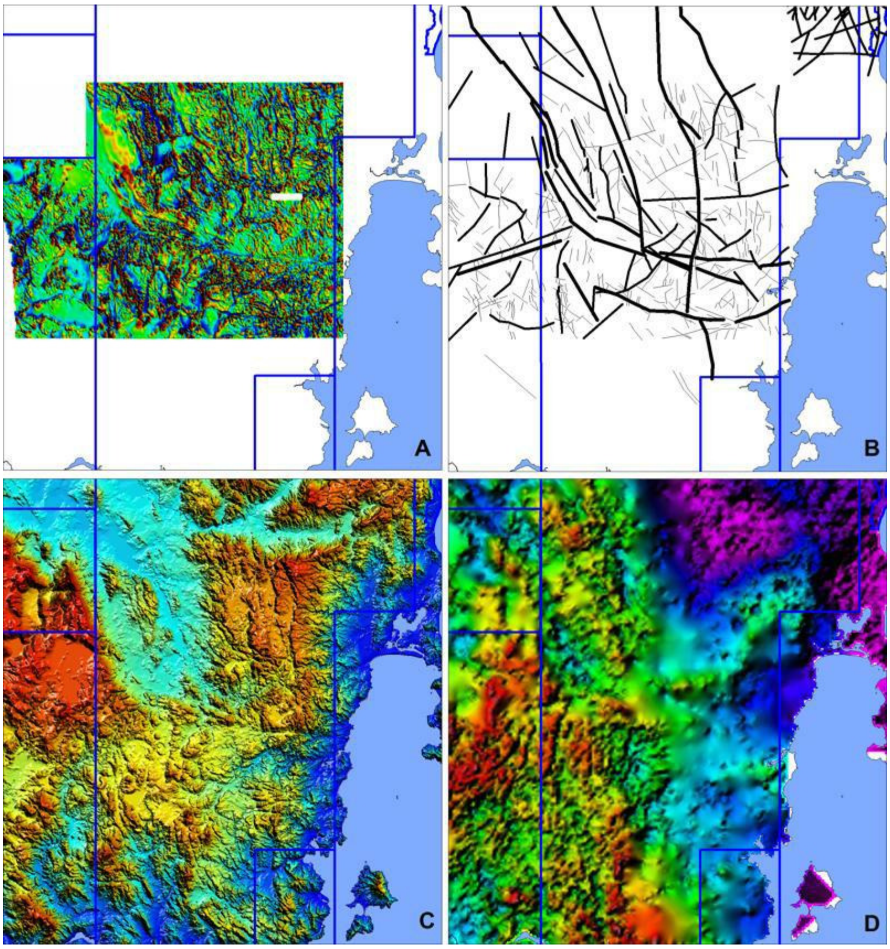

Figure 12: Map images of the Midlands area showing the KUTh tenement boundaries (blue) superimposed on (a) total magnetic intensity from combined KUTh/AGSO aeromagnetic surveys; (b) interpreted magnetic lineaments; (c) digital terrain image; and (d) residual Bouguer gravity anomaly (determined using the MANTLE07 model of Leaman, 2008).

3.3 Gravity Infill 2010

Infill gravity data acquisition was undertaken in the first half of 2010 to provide additional information on the predicted depth to granite bodies in the vicinity of the Charlton-Lemont resource. Information derived from aeromagnetic data and the 3D MT modelling suggests a complex array of potentially permeable fracture zones within this region, including a major east-west structure which appears to extend eastwards into the vicinity of predicted granite subcrop. In light of these observations, and given the gaps in the existing gravity coverage, it is anticipated that additional data will provide useful detail that will assist with planned drill targeting in this area.

The results of the new gravity data acquisition will be subject to 2D and 3D geophysical modelling to further refine the currently predicted depth to top granite of Leaman (2008).

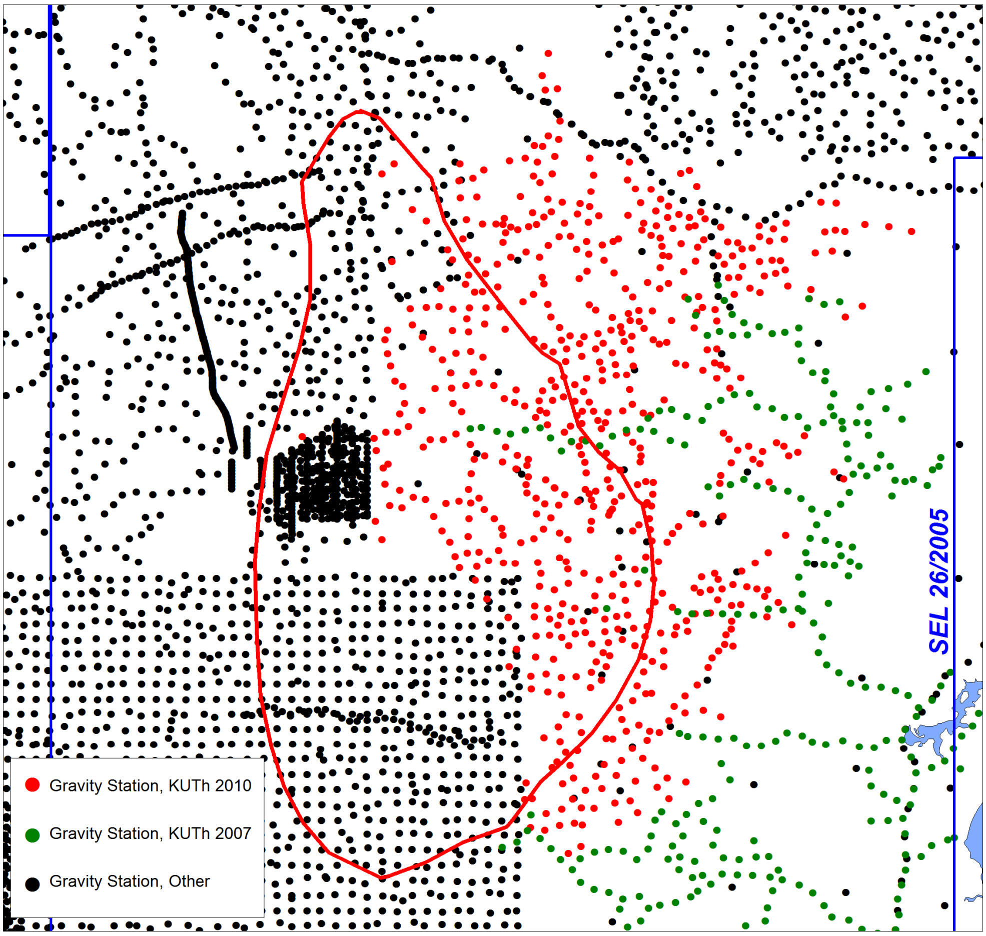

Figure 13: Map of 2010 KUTh Gravity station locations. Red outline indicates surface projection of the Charlton-Lemont resource area.

Data acquisition

Combined GPS and gravity data acquisition were undertaken on behalf of KUTh Energy by Solo Geophysics in April-May 2010. The vehicle-based survey was designed to infill an area of poor data coverage across the central Midlands area (Figure 13). A total of 626 data points were recorded along both public and private roads and tracks as well as forestry roads and trails. Gravity data were recorded using a LaCoste & Romberg Model G #556 gravity meter in loops from established gravity control points located at Ross and Oatlands. Additional base ties to a daily field base station were also used for data control. Regional tie points were used for drift checks. In each case time of measurement was recorded in EST and used to perform tidal corrections via Longmans' formula referencing UTM +9hrs.

Occupied gravity stations were spaced at ~1000m intervals on accessed roads and tracks (or at satellite visible areas in forested regions). Stations were located using a real time RTK GPS system (Leica 1200 dual frequency; 4W/25W UHF 467.075Mhz radio link; Garmin GPS60). Location data were recorded in GDA94 datum and transformed to AGD66. Final AHD elevations were derived using a standard ellipsoid to geoid file produced for the local area by Geoscience Australia. Survey resolution was >0.05m for both horizontal and vertical measurements. Limits on satellite availability placed restrictions on the useful survey periods in areas of dense vegetation. Some delays were experienced in data acquisition as a result of teleseismic noise from significant earthquake events in Indonesia.

Full details of the gravity acquisition, including calibration details, GPS base station locations and raw and tidal corrected data are provided in Appendix 7.

Data Processing

Tidal corrected data were further adjusted for instrument drift at base, daily drift and latitude. Drift corrected tie data are recorded as AGSO Isogal65 values. A single Bouger density of 2.67g/cm^3 was required to calculate Bouger corrections. Bouger adjustments and terrain corrections were both carried out by Dr David Leaman. Final processed data are provided in Appendix 7.

Data Interpretation

Interpretation of the 2010 infill gravity survey data is being undertaken by Dr David Leaman and remains in progress at the time of reporting. Completion of initial interpretation work is currently expected in July 2010.

3.4 Thermal modelling and resource estimation

Following the success of the surface heat flow mapping program, and successful resource definition at Charlton-Lemont in 2008/2009, work commenced upon the production of a second 3D geomodel for estimation of a 'contained' or 'stored-heat' geothermal resource, this time in the Fingal area. The area chosen for modelling focussed upon the very high heat flows observed in the Mt Nicholas (106mWm^{-2}) and Fingal (97mWm^{-2}) drill holes in the north-east of the tenement. A 3D earth model was constructed by Hot Dry Rocks PL covering an area of 3300km^2 in the Central Midlands (549,500 - 609,500mE; 5,355,000 – 5,410,000mN; AMG94, Zone 55) and to a depth of 7km. The model was constructed using a simplified stratigraphy comprising six layers: Air (topography), Jurassic Dolerite, Upper Parmeener, Lower Parmeener, Mathinna and Devonian Granite (Figure 14). Layer geometries of these units were constrained using data derived from various sources, including drilling, seismic and gravity interpretations (Table 4). A diagrammatic summary of the model area and the location of input data sources are provided in Figure 15.

The layer model was 'voxelated' (cell size 500m x 500m x 50 m (xyz)) and thermal properties (thermal conductivity and heat production) were assigned to each voxel on the basis of stratigraphy. Rock property data used were derived from a range of sources as described in Table 4. A conductivity-lithology mixing exercise demonstrated minor statistical differences between the arithmetic and harmonic mean thermal conductivities of the Upper and Lower Parmeener Units in this area and hence a minor thermal anisotropy was assumed for these rocks. For Mathinna Units, which are also known to be anisotropic with respect to thermal conductivity, this property was assumed to be that a mean case with average dip of foliation of 45°. This was consistent with the approach taken for the Charlton-Lemont resource model and is appropriate in the absence of specific detailed structural data at depth. A summary of all model input values is provided in Table 5.

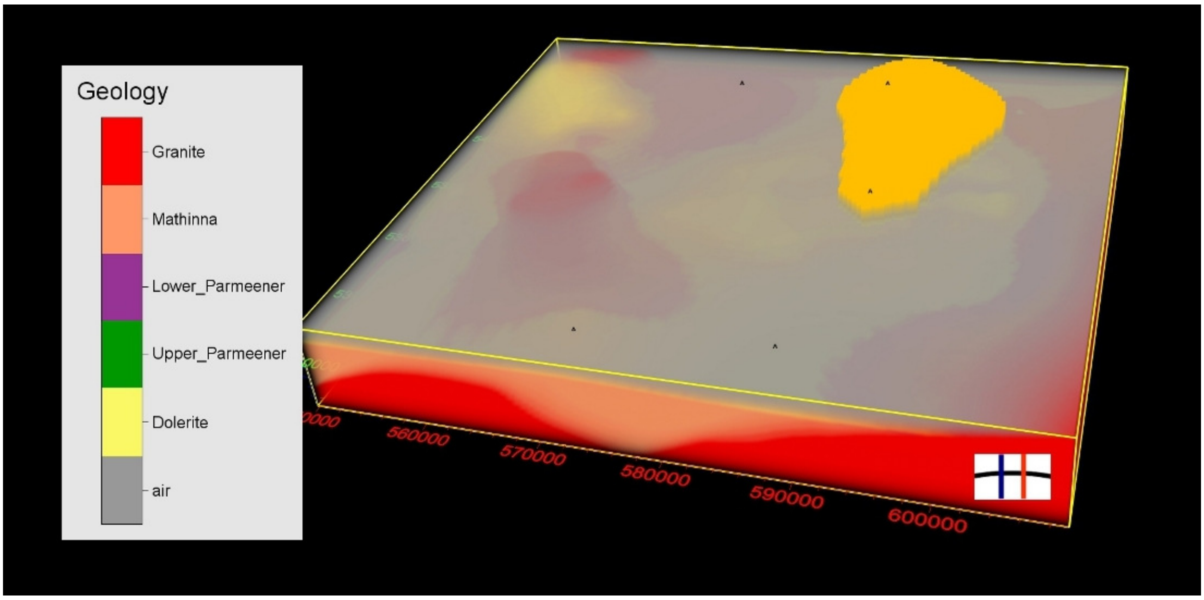

Figure 14: 3D earth model of the Nicholas-Fingal area as produced by HDR PL showing location of shallow heat flow constraints and resource area (solid). Model input values are described in Table 5.

Model Input	Jurassic Dolerite	Upper Parmeener	Lower Parmeener	Mathinna	Devonian Granite
Layer Geometry	Combined outcrop and drill data	Combined outcrop and drill data & isopachs from Burrett and Martin (1989).	Combined outcrop & drill data and isopachs in Reid (2002).	Combined outcrop & drill data	Combined outcrop, drill and depth to top-granite data from Leaman (2008)
Thermal Conductivity	KUTh SHFP*	KUTh SHFP	KUTh SHFP & Rast (2009)	KUTh SHFP & Goh (2008)	Goh (2008)
Heat Production	Assumed (nil)	Assumed (nil)	Assumed (nil)	Goh (2008)	Goh (2008)
Density	n/a	n/a	n/a	Goh (2008)	Goh (2008)
Specific Heat	n/a	n/a	n/a	Goh (2008)	Goh (2008)

Table 4: Data sources for the various parameters of the Nicholas Fingal 3D model (*SHFP = Shallow Heat Flow Program).

A 3D conductive heat flow inversion model was used to predict temperature increase at depth from which a stored-heat estimation was made. Thermal modelling was constrained by measured values of surface heat flow and temperature gradient in ten holes from KUTh's shallow heat flow drill program (Table 6). A Hot Rock reservoir was defined based upon a cut-off temperature of 150℃ and a maximum depth of 5km. Cut-off temperature is the minimum economic reservoir fluid temperature for commercial energy extraction and in this instance was based upon the requirements of a low-temperature organic rankine-cycle binary power plant. A volume of 384km^3, entirely contained within Devonian Granite, was identified as meeting the criteria for Hot Rock reservoir.

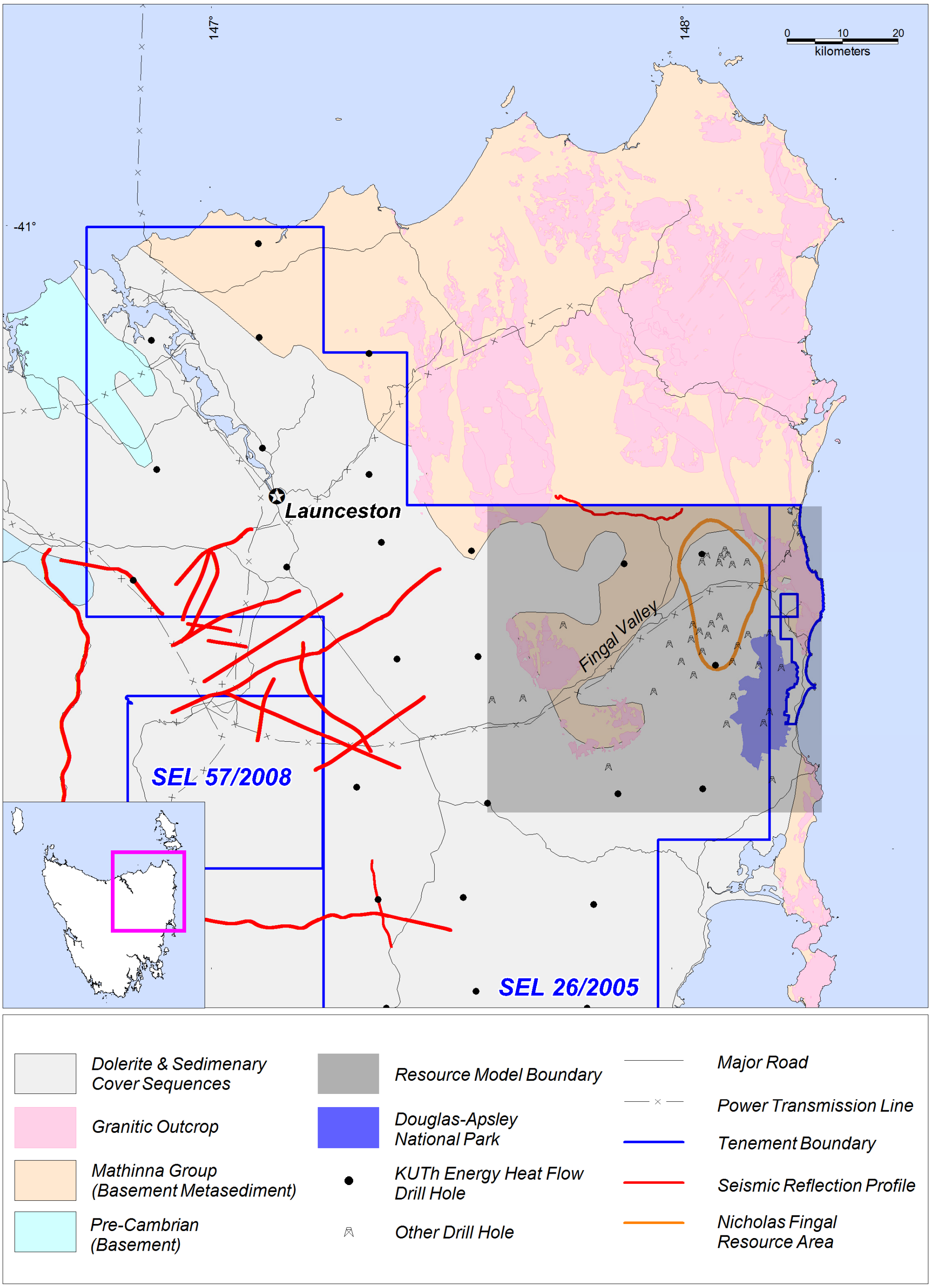

Figure 15: Location map of the Nicholas-Fingal 3D geomodel area showing location of input data and surface projection of the resource volume.

Stored-heat or thermal-energy-in-place represents the amount of heat contained within a volume of rock. For the purposes of resource estimation, only that portion of the stored-heat energy which has reasonable prospects for eventual economic extraction is considered. A stored-heat estimation was made for the reservoir by assigning values of heat capacity and density to the relevant lithologies in the thermal model (Table 5). The stored-heat estimate considered only that portion of energy present above a 'base' or 'rejection' temperature of 70℃. This value represents the temperature at which a low-temperature organic rankine-cycle binary power plant rejects fluid and is therefore the limit on the amount of energy that can be drawn from the geothermal resource.

Parametre	Value
Cut-off Temperature	150°C
Base Temperature	70°C
Base of Reservoir	5000m
Reservoir Volume, Granite	$384km^3$
Density, Granite	$2,580kg/m^3$
Specific Heat, Granite	950J/kg/K @ 178°C
Heat Production, Mathinna	$1.61\mu W/m^3$
Heat Production, Granite	$7.33\mu W/m^3$
Thermal Conductivity, Dolerite	2.17W/mK
Vertical Thermal Conductivity, Upper Parmeener	1.69W/mK
Horizontal Thermal Conductivity, Upper Parmeener	1.88W/mK
Vertical Thermal Conductivity, Lower Parmeener	2.05W/mK
Horizontal Thermal Conductivity, Lower Parmeener	2.09W/mK
Thermal Conductivity, Mathinna	3.80W/mK
Thermal Conductivity, Granite	3.50W/mK

Table 5: Summary of Nicholas-Fingal resource model parameters and input rock property data.

Hole	East	North	Heat Flow (mW/m^2)
Tower Hill	573964	5399699	83 ± 1.0
Fingal 3	590381	5381540	97 ± 2.9
Snow Hill	572873	5358389	92 ± 2.3
Mt Nicholas	587962	5401440	106 ± 1.3
Swan 2	588102	5359269	85 ± 1.2
Elizabeth	549501	5356701	94 ± 2.4

Table 6: Heat Flow values used as constraints on the 3D temperature algorithm inversion used in the Nicholas-Fingal resource estimation. All coordinates are in MGA94 Zone 55.

The results of the stored heat estimation are presented in Table 7. Based upon the available data and the current level of uncertainty this estimate is considered to be an Inferred Geothermal Resource, as defined by the Australian Code for Reporting of Exploration Results, Geothermal Resources and Geothermal Reserves (2008) ("Geothermal Code"). Methods used in determining this resource estimate are in accordance with those outlined in the accompanying Geothermal Code Lexicon (2008) and the estimate has the approval of Dr Graeme Beardsmore, who is a Competent Person as defined under the Geothermal Code. Dr Beardsmore's full formal resource statement is included in Appendix 8.

Reservoir	Stored Heat (PJ_{th})	Volume (km3)	Inferred Geothermal Resource (PJ_{th})
Granite	101,450	384	101,000

Table 7: Estimated geothermal resource in the Nicholas-Fingal Geothermal Play. Resource estimate is rounded to nearest $1000PJ_{th}$.

4 Research & Collaboration

Several research and collaborative projects with KUTh support were completed or were underway during the reporting period.

4.1 K. Rast Honours project 2009

A sponsored Honours project was undertaken by student Katrina Rast during 2009 (Feb-Nov) at the University of Tasmania. The purpose of this project was to record various petrophysical, geochemical and thermal properties of the Parmeener Supergroup sediments. These basic rock property data are necessary for geophysical and thermal modelling and were used in the recent Inferred Resource estimation. A copy of the thesis (Rast, 2009) can be found at the School of Earth Sciences (UTAS) and the MRT Library.

4.2 UTAS Legacy Seismic Data Review

A KUTh-sponsored student project "Earthquakes in Tasmania: a review of data holdings and potential future analysis" was undertaken to provide a clear summary of legacy earthquake data (location and magnitude) available in the State. Work was undertaken in December 2009 by UTAS undergraduate Kyen Knight under the supervision of Drs Anya Reading and Michael Roach. The project resulted in the production of a report detailing the quality and availability of Tasmanian seismic event data from four publically accessible datasets (UTAS, Geoscience Australia, the International Seismic Centre and the Incorporated Research Institutions for Seismiology Event Catalogue). It is anticipated that the results of this report will be utilised in future studies of seismic risk ahead of geothermal development in Eastern Tasmania.

A full copy of the final project report is included in Appendix 9.

4.3 Ambient Seismic Energy Technique 2 (ASET1) (October 2009 – ongoing)

Dr Anya Reading, Senior Lecturer in Geophysics at the UTAS, is leader and co-ordinator for this project which is a collaborative ARC-linkage partnership between KUTh and the UTAS. The project is entitled '3D Seismic Velocity Structure for Geothermal Exploration' and commenced in the Midlands in October 2009 following some delays due to local flooding. The aim of the project is to further investigate the ways in which ambient seismic energy may be used to determine structure in the upper 10 km of the crust and follows the success of an initial pilot project (ASET1) deployed in 2009.

A total of 16 seismic stations were deployed in October 2009, requiring the installation of solar panels and Orion recording units (Figure 16). Six stations were redeployed in early 2010 to widen the seismic array and one other was moved to higher ground due to flooding at the site. All sites were located on private land between Ross and Woodsale, and were emplaced with the permission of the landowners. Data is collected from the stations once a month and are expected to be uplifted at the end of the year or early 2011. At the time of reporting, data processing and interpretation were ongoing. Dr Reading intends to publish the results of her work after the interpretations are complete.

See Appendix 10 for the locations of the ASET2 array.

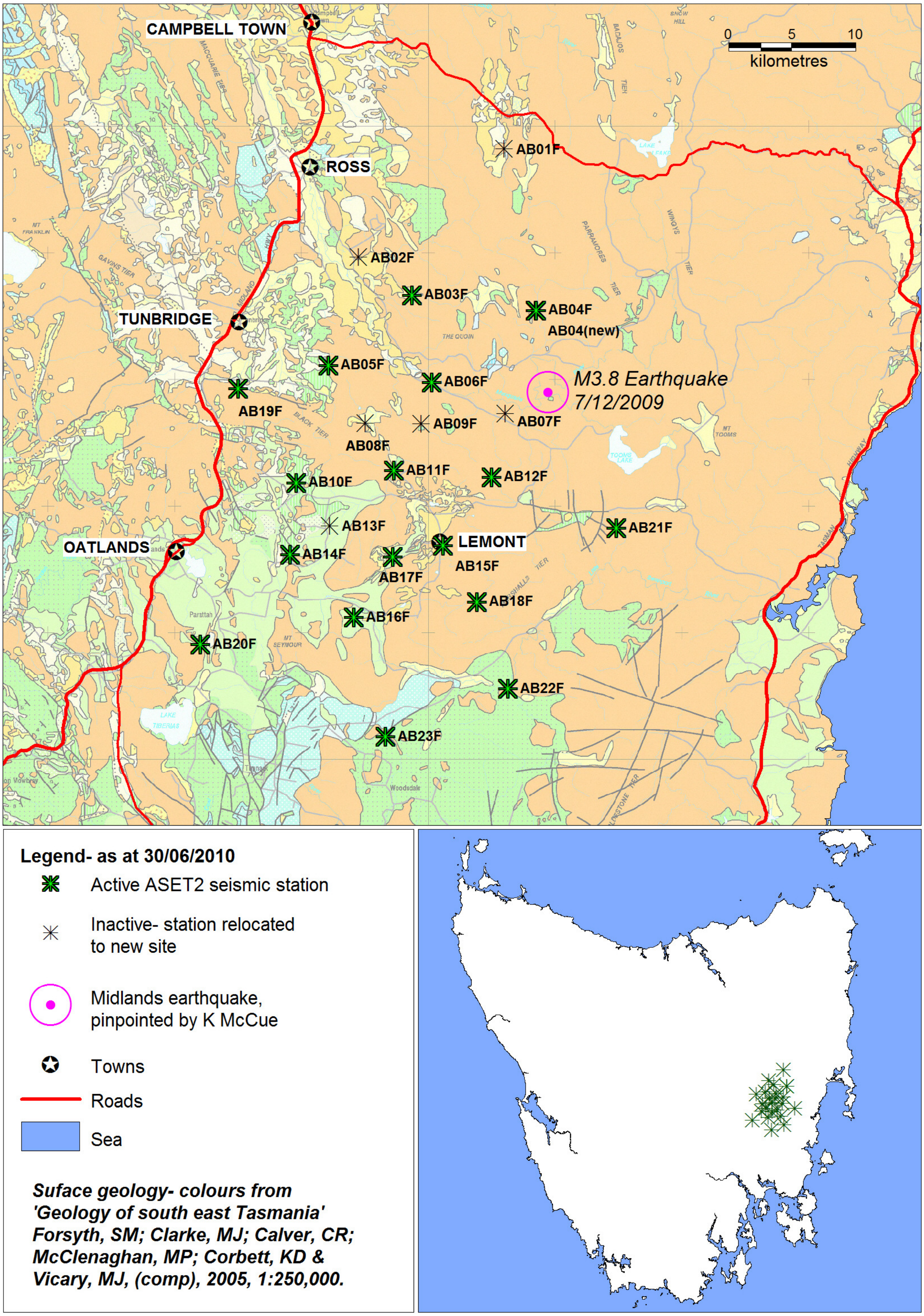

Figure 16: Location map for the ASET2 project deployment.

4.3.1 Midlands Earthquake Event

Shortly after the deployment of the ASET2 array a small, naturally occurring earthquake event was observed in eastern Tasmania. The event, which was subsequently located within the vicinity of the ASET2 network at a depth of 8 - 10km (Figure 16), was recorded at half-past midnight very early on 8th December 2009, local date and time. The earthquake was also recorded on the national (Geoscience Australia) network where it was determined as having magnitude ~3.4.

This event was successfully recorded on 14 instruments within the ASET2 array. These data, in addition to that of the publically available networks, present a unique opportunity to undertake earthquake analysis in Tasmania. Using them, a Focal Mechanism Solution (FMS) was undertaken on behalf of KUTh by Dr Kevin McCue of the Australian Seismological Centre (ASC). The results of this work, which are considered to be of "fair" reliability predict a predominantly thrust mechanism with an approximately east-west horizontal principle stress direction. This accords both with available data for mainland eastern Australia and with predictions from existing crustal stress models (Hillis & Reynolds, 2000). Details of the full FMS are presented in Table 8. Full results of the Midlands earthquake focal mechanism solution are included in Appendix 11.

	Strike	**Dip**
Plane 1	25	64
Plane 2	0	30
P axis	103	20
T axis	315	68

Table 8: FMS solution for December 2009 Midlands earthquake.

5 Discussion

At the completion of 2008/2009 a total of six geothermal targets had been identified as a result of KUTh's ongoing exploration program (Figure 17). Of these, two have since been subject to successful resource analysis exercises (Charlton-Lemont and Nicholas-Fingal), two now appear from geophysical data as likely extensions of the Charlton-Lemont system (Tooms-Leake, Macquarie) and two remain largely unappraised (Ben Lomond, Rheban) due to work prioritisation into the defined resource areas.

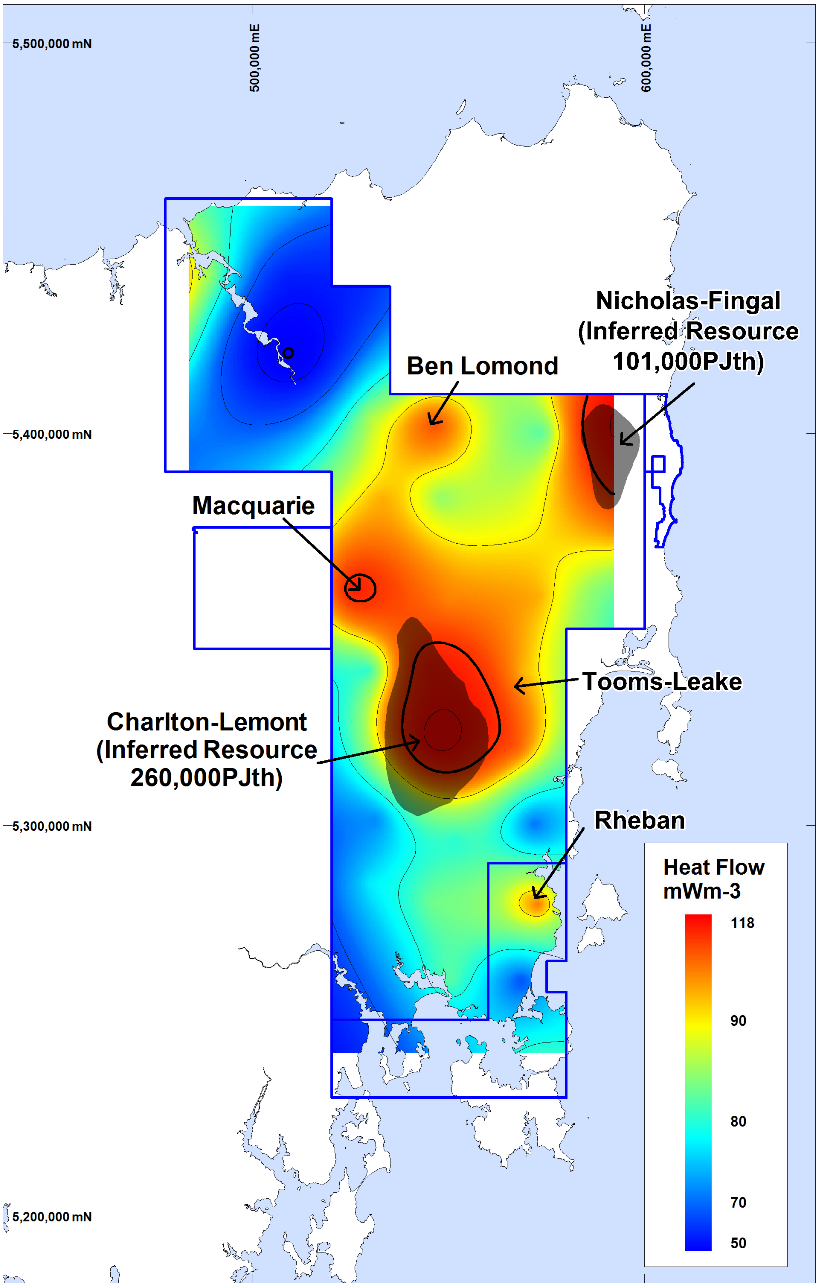

Figure 17: EGS targets in KUTh's tenements (as delineated in 2008/2009) as indicated by the labels. Targets are named according to their geographic region. Dark shading indicates the surface projection of established resource areas.

5.1 Charlton-Lemont

The striking spatial coincidence of apparently deep fractured zones (interpreted from gravity and aeromagnetic data), electrically conductive MT anomalies and anomalously high heat flow within the Charlton-Lemont (CL) region has led to a significant shift in the conceptual play model devised for this area. Originally conceived as a relatively high temperature, low permeability Hot Rock prospect, CL now appears to host what may be a Naturally Fractured Hot Rock play (Figure 18) with potential for warm/hot fluids at depth along zones of fracture permeability. Geophysical data acquisition in this area is now reaching completion and further investigation of this complex target model will necessitate the drilling of a deep hole (2 – 4km) to further clarify the nature of the geology at depth and to reduce risk ahead of future potential development. The cost and risk associated with this work imply a strong need for objective drill targeting based on comprehensive, high quality data to best ensure the chances of success. It is for this reason that the deep drilling program has been delayed during the past year to enable the collection of additional infill geophysical data.

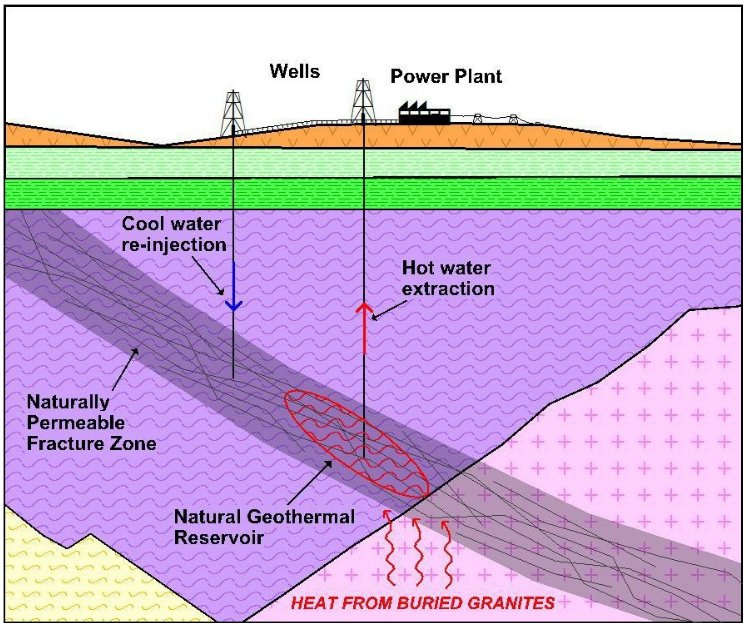

Figure 18: Diagrammatic illustration of Naturally Fractured Hot Rock play concept (Charlton-Lemont)

Data derived from successive MT surveys completed in 2009-2010 have now been returned and have significantly improved the resolution of electrically conductive zones within the CL area. Areas of high electrical conductivity are now seen to be of planar geometry and are confirmed as basement features typically commencing around 2km depth. Significantly, the east-west striking component of this feature appears to intersect areas of predicted granitic sub-crop in the east. It is anticipated that the newly acquired infill gravity data will assist in further refining predicted depth-to-granite models in this area and may provide useful information on the nature and orientation of the deep structures in this region. Final drill targeting at CL will not be attempted until the results of this work have been returned.

Additional project work, aimed at furthering the geological understanding of this area, includes the application of recent acquired earthquake FMS data, together with geological and structural information derived from geophysics in the construction of a regional stress model. The aim of this work will be to investigate the likely distribution of permeability along regional fracture trends based on the interaction of stress, fracture geometry and formation rheology. Complimenting this work will be a study of regional stress utilising earthquake data. This latter work will incorporate an assessment of the local and regional seismic risk and will provide recommendations for future seismic data acquisition ahead of any potential geothermal development.

A limited program of bore and spring water sampling in the Midlands area that was planned for the past year was delayed indefinitely due to an influx of meteroric water during the regional flooding of this area in Winter-Spring 2009. At least one candidate for (cold) spring sampling has been identified, however, and this may be followed up by geochemical sampling in the coming year should the relatively dry weather persist.

It is probable that the ongoing acquisition and modelling of new data at CL will alter the predicted geological relations at depth sufficiently to warrant the reappraisal of the existing inferred resource model for this area. Should this be the case, it is anticipated that the existing modelled area, which currently incorporates both the CL and Tooms-Leake targets, will be expanded slightly to further include the Macquarie anomaly to the north-west. This target, which was originally excluded on the basis of its anomalous location (west of predicted granite occurrence), is now considered likely be part of the same fracture-related system that is observed at CL.

5.2 Nicholas-Fingal

The newly defined resource at Nicholas-Fingal (NF) is associated with a Hot Rock conceptual play that is significantly simpler than that at CL (Figure 19). Development at this resource is expected to be that of a typical Enhanced Geothermal System (EGS) in granite where permeability augmentation is required at depth. The major drill target in this area is thus the granite body which is currently predicted to underlie the entire resource area. Consequently drill targeting decisions in this area are expected to revolve around engineering and logistical considerations such as access and topography.

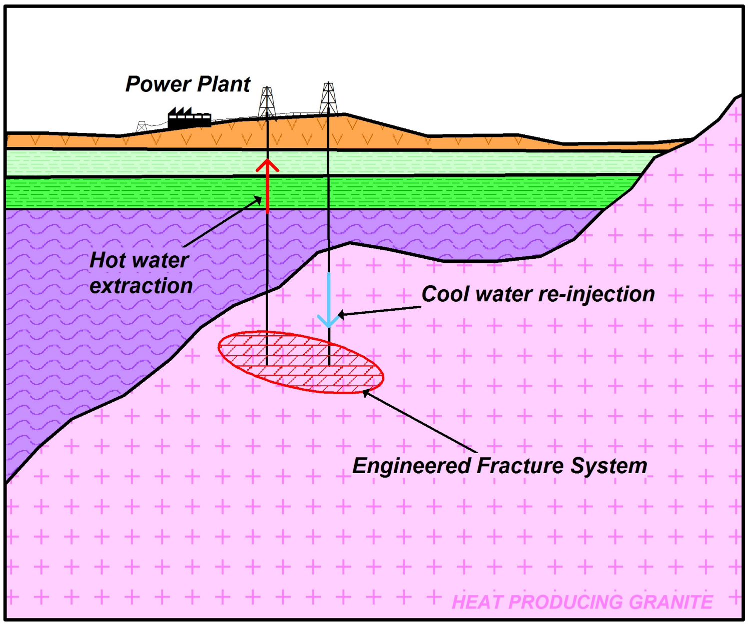

Figure 19: Diagrammatic illustration of Hot Rock play concept (Nicholas-Fingal)

Whilst the relative simplicity of the play model at NF reduces the complexity of drill targeting decisions it does not reduce the anticipated resource risk which centres upon the predicted temperature at depth. The existing inferred resource is based upon shallow drill holes only and is highly reliant upon the correct assumption of thermal conductivity values for the Upper Parmeener (UP) Units. The current resource estimation relies upon a limited dataset of UP values that are derived from KUTh's shallow drill program. To provide further statistical assurance that these data accurately reflect the bulk thermal properties of the UP formation an additional program of thermal conductivity analysis is currently being conducted. This work, which is utilising core samples from legacy drill holes in the NF region, is expected to be completed in July 2010.

No further geophysical data infill is currently considered necessary at NF. It is expected that the regional stress and seismic risk studies discussed above will also incorporate the NF area.

Resource risk at NF can only be reduced via drilling of a deep test bore to test the thermal model and record temperature at depth. An intermediate depth (2 – 4km) slimline hole similar in style to that proposed at CL is currently being considered for this application. This style of drilling potentially represents an economical way of reducing project risk ahead of deep production drilling.

5.3 Rheban

The Rheban thermal anomaly is a small single-hole anomaly ($94mWm^{-2}$) located in the north-east of SEL 45/2007. The location of this anomaly, offset to the south and east of the main CL anomaly is suggestive of a possible link to the geology in this area. The major east-west structure currently observed at CL coincides spatially with an east-west termination of the main heat flow anomaly with areas immediately to the south recording significantly reduced heat flows ($<80mWm^{-2}$). In this instance the anomaly at Rheban could be interpreted as an offset of the main heat flow anomaly. It is anticipated that data derived from refined gravity modelling of granite distribution at CL may improve the current understanding of the geological relationships in these areas.

The nature of the Rheban anomaly is thus of interest to the broader understanding of crustal architecture in this region. Geological review of this area reveals relatively little available data, however, with sparse geophysical coverage. A sponsored honours project at the University of Tasmania is currently proposed for 2011 to collect geophysical profiles (gravity and magnetic) across the heat flow anomaly and enable more detailed modelling of granite at depth.

5.4 Ben Lomond

To date no project specific work has been completed in this area beyond the existing shallow heat flow hole ($97mWm^{-2}$). At present this target area is on hold as a relatively low priority and no project specific work is anticipated for 2010/2011.

5.5 Project Drill Planning

Following the completion of outstanding project work KUTh will undertake a detailed process of drill targeting at both its Charlton-Lemont and Nicholas Fingal resources. The determination of primary and secondary drill target locations within both resource areas will be followed by prioritisation between the resource areas and a subsequent process of detailed drill planning. KUTh is currently in discussion with several drilling operators regarding the possible options for drilling. It is the company's intention to pursue a deep slim-line (exploration) drilling option for these holes in preference to full scale production drilling. The company sees several advantages to this option, particularly in cost but also in appropriateness to the level of geological risk inherent in these areas, most particularly at Charlton-Lemont.

A number of slim-line drill options are available to KUTh, including rotary, percussion and cored holes. In the latter cases, the drilling rig required to reach the anticipated target depths (2 - 3km) will be relatively novel. KUTh is currently in discussion with two separate providers regarding the potential for application of their technology to the problem of deep slim-line drilling in hard rock. In both cases the drilling rigs in question are new and the KUTh drilling would form part of the rig-proving process. Whilst this necessarily increases the risk of the drilling project, these novel rigs appear to be the only technology currently available to drill slim-line to target depths >2km. It is worth noting that KUTh is not the only geothermal explorer currently investigating deep slim-line drilling in Australia. The company is one of several that will be contributing to a Joint Industry R&D project "Deep Exploration Slim-hole Geothermal Drilling" which is being run through the Australian Geothermal Energy Group Technical Interest Group (11) – Drilling and Well Construction.

The process of drill rig evaluation, site evaluation, permitting and drill planning and engineering at the chosen target site is expected to be lengthy and will require significant expenditure. The cost of drilling itself has not yet been finalised but is anticipated to be >$1M. At present it is anticipated that drilling will commence in 2011.

6 Conclusion and Recommendations

Work completed to date has successfully defined a number of significant geothermal targets for geothermal development in Eastern Tasmania. 3D geothermal modelling infers an aggregated Geothermal Resource of >350,000PJ_{th} at two sites at Charlton-Lemont in the Midlands and Nicholas-Fingal in the north east. Recommendations for future work on target areas within tenement SEL 26/2005 include:

- *Gravity modelling (2D/3D) at the CL resource ($10K)*
- *Stress modelling work at CL ($10K)*
- *Seismic risk studies of eastern Tasmania and resource areas ($10K)*
- *Acquisition of additional rock property data from the Upper Parmeener Unit at NF ($1K)*
- *Data compilation, drill targeting and prioritisation at CL and NF ($10K)*
- *Evaluation of potential deep slim-line drilling rig options ($50K)*
- *Drill planning and engineering, permitting and site preparation ($500K)*
- *Drilling and evaluation of an 'intermediate' depth slim-line bore hole (2-3km) on SEL 26/2005 (>$1M)*

Work recommended for additional targets areas in SEL 45/2007 is:

- *Ongoing data compilation and geological assessment ($20K).*
- *Sponsorship of an Honours project to acquire and assess geophysical data to better define the geothermal anomaly observed in the Rheban area ($3K)*

With the expectation of drilling and the completion of geophysical work, expenditure on SEL 26/2005 is anticipated to be in excess of $1.6M in the 2010 – 2011 year and will thus make up for a shortfall experienced in the current year expenditure due to delays in drilling arising from the expansion of the geophysical program at CL. Expenditure on SEL 45/2007 will be considerably less ($23,000) reflecting the lower priority assigned to the Rheban geothermal anomaly.

7 Environment

7.1 MT station rehabilitation

Environmental disturbance due to the MT survey was minimal. In all cases MT station sites were assessed for the presence of rare or endangered plant species prior to digging. Digging of the vertical Hz component was carried out using a petrol powered post-hole digger. All other components were dug using suitable hand- tools. Care was taken at all sites to ensure that equipment was cleaned on completion of digging. Upon removal of equipment all trenches/holes were rehabilitated by replacement of the original soil and divots. Before and after shots of selected MT stations are also included in Appendix 12.

8 Expenditure

Details of expenditure on SEL 26/2005 across the 12-month period 7/7/2009 – 6/7/2010 are captured in Table 11 below. For convenience, equivalent figures for SEL 45/2007 are also presented although it should be noted that financial reporting on this tenement is separate and will be detailed separately at anniversary in November 2010.

Delays in the onset of deep drilling which have allow for the collection of additional infill geophysical data have resulted in the total annual expenditure on SEL 26/2005 falling below that previously programmed for 2009/2010 (>$1.2M). However, it should be noted that total cumulative expenditure on both SEL 26/2005 and SEL 45/2007 remains well in excess of that detailed in both the original licence documents and ongoing work program commitments.

	SEL 26/2005	**SEL 45/2007**
Geoscience Costs	$	$
Geology	131,981	4924
Geochemistry	-	-
Geophysics	270,862	1287
Remote Sensing	-	-
Drilling & Gridding		
Gridding	-	-
Drilling	-	-
Land Access Costs	7111	3606
Rehabilitation Costs	-	-
Feasibility Study Costs	36017	-
Other Costs	27356	-
Administrative Costs	18974	1307
TOTAL 09/10	492301	11124
Total Expenditure	3,406,272	318,802

Table 11: Expenditure on KUTh tenements SEL 26/2005 and SEL 45/2007 in the 12-month period 7/7/2009 – 6/7/2010.

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10 Keywords

Geothermal exploration
Geothermal resource
East Tasmania
HDR (Hot Dry Rock)
HFR (Hot Fractured Rock)
EGS (Enhanced Geothermal System)
High Heat Producing (HHP) granite
Tamar Conductivity Zone (TCZ)
Magnetotelluric
Gravity