ENVIRONMENTAL IMPACT REPORT

Geophysical Operations in the Anangu Pitjantjatjara Yankunytjatjara Lands Region of the Officer Basin.

July 2009

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AHAVA ENERGY

Project director	Danielle Martin		
Project manager	Justin Rowntree		
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Coffey Natural Systems Pty Ltd ABN 61 005 041 878
Level 1, 2-3 Greenhill Road, Wayville, South Australia 5034 Australia
T (+61) (8) 7221 3588 F (+61) (8) 7221 3510
coffey.com

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1. EXECUTIVE SUMMARY

This environmental impact report (EIR) for Ahava Energy relates to exploratory geophysical exploration surveys within the Ananngu Pitjantjatjara Yankunytjatjara Lands ('the Lands') in north-western South Australia. Under the *Petroleum Act 2000* (SA) licensees must provide an EIR where they plan to conduct regulated activities, including exploration activities, within South Australia. This EIR provides information on the activities being carried out, a description of the region, the risks and proposed management of those risks, and any planned or realised stakeholder consultation.

The information provided in this EIR has been collated from desktop review, government database searches and survey reports as well as from extensive consultation on the Lands about petroleum exploration. The collated data has been used to identify the potential environmental and social risks of geophysical exploration surveys to be conducted on the Lands. Based on the environmental information and risk assessment provided in this document, a statement of environmental objectives (SEO) has been developed, as a requirement under the *Petroleum Act 2000*.

For the purpose of this document, 'environmental impacts' include impacts on society and the way of life of Ananngu Pitjantjatjara Yankunytjatjara people (refer section 2.1 Definition). Throughout this document, peoples belonging to the Ananngu Pitjantjatjara Yankunytjatjara Lands are called, 'Ananngu', meaning 'people'.

It is noted that this EIR and the associated SEO represent the first of their kind prepared for a portion of the Ananngu Pitjantjatjara Yankunytjatjara Lands. As a result, the unique land tenure of the lands, its occupancy and use, and in some areas, its largely undisturbed nature, have been factored into the preparation of this documentation.

This document has also been prepared in the context of a broader program of environmental and social planning on the Lands, driven by the Ananngu Pitjantjatjara Yankunytjatjara Executive Board. In anticipation of future resources development, the Executive Board has taken active steps to ensure such activities on the Lands act as a stimulus for broader improvement of the social situation on the Lands. It is understood both parties – Ananngu Pitjantjatjara Yankunytjatjara and Ahava Energy – have agreed to collaborate to ensure such exploration and other future activities are conducted in a way which is aligned to the aspirations and needs of the Ananngu Pitjantjatjara Yankunytjatjara Lands communities and helps maximise the benefit for those communities.

Ahava Energy has and will continue to undertake focused consultation with stakeholders and other interested parties during the planning for and implementation of exploration programs.

Geophysical exploration activities involve the; clearing and preparation of lines, access tracks and campsites; surveying and recording of data; and when required, uphole drilling, rehabilitation auditing and monitoring. The potential environmental impacts associated with these activities include:

- Disruption of Ananngu way of life.
- Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites.
- Injury of persons.

- Visual impacts.
- Facilitation of third party access.
- Disturbance to land surfaces.
- Dust generation.
- Disturbance to drainage patterns.
- Contamination of soil and water.
- Disturbance or loss of vegetation and habitat.
- Dispersion of weeds and pathogens.
- Disturbance to native fauna.
- Provision of passage to invasive fauna species and predator species.
- Disturbance to livestock.
- Damage to infrastructure.
- Generation of litter and unnecessary pollution.

It is noted that geophysical exploration activities in PEL 138 will be excluded from the active Mintabie opal fields (as defined in Figure 2.1) and no impacts to this area will occur.

Exploration activities also create the potential for:

- Training and employment of Anangu for anthropological and environmental clearances, clearing and preparing lines, clearing access tracks and campsites. Training and employment may have the potential to occur in other areas of operation and logistics also.
- Identification and preservation of cultural artifacts.
- Provision of additional information about the environmental and cultural characteristics of the Lands.

The geophysical exploration activities proposed by Ahava Energy are generally considered to be of a low risk and the impacts are considered manageable. Ahava Energy and their contractors will employ a range of practices and protocols to ameliorate any potential impacts. In addition, the geophysical exploration on the Lands will facilitate the Anangu Pitjantjatjara Yankunytjatjara communities' desire to promote and coordinate petroleum exploration in order to advance their own aspirations for social development.

2. INTRODUCTION

Ahava Energy holds Petroleum Exploration Licence (PEL) 139 and Petroleum Exploration Licence Applications (PELAs) 148 and 148 in the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin. A requirement of the *Petroleum Act 2000 and* Petroleum Regulations 2000 is that no regulated activity (such as seismic exploration for petroleum) under a licence can be carried out unless an approved statement of environmental objectives (SEO) has been developed and approved. To determine the environmental objectives as stated in the SEO, an Environmental Impact Report (EIR) is first required.

This EIR has been prepared to satisfy the requirements of the *Petroleum Act 2000* and its Regulations. More specifically this EIR will provide the following information as required by Regulation 10 of the Petroleum Regulations 2000:

- A description of the activities to be carried out.
- A list of all owners of the relevant land.
- A description of the natural, cultural and socio-economic features of the environment that may be affected by the activities.
- A description of actual and potential events associated with the activities that could threaten various aspects of the environment, including their likelihood and level of certainty in their prediction.
- An assessment of the potential consequence of the above defined events on the various aspects of the environment.
- Detailed information on the extent to which these potential consequences can be managed and mitigated.
- Information on any consultation conducted with the relevant landowners, government agencies and other stakeholders.

2.1 Definition

Section 4(1) of the *Petroleum Act 2000*, provides the definition of *environment* as encompassing:

- Land, air, water (including both surface and underground water), organisms and ecosystems.
- Buildings, structures and cultural artefacts.
- Productive capacity or potential.
- The external manifestations of social and economic life.
- The amenity of an area.

This EIR aims to incorporate all aspects of this definition.

It is noted that through the definition of ‘the external manifestations of social and economic life’ that this has particular reference to any potential impacts on society and the way of life of Ananngu Pitjantjatjara Yankunytjatjara people.

2.2 Ahava Energy

Ahava Energy is an Australian oil and gas exploration company formed in 2008. The company aims to be a successful oil explorer and developer while maintaining its environmental and cultural responsibilities.

Ahava Energy presently holds (as of July 2009) three PELs within the Officer Basin, being PELs 138, 499 and 500. PELs 499 and 500 (formerly PEL 139) are located outside of the border (to the east) of the Ananngu Pitjantjatjara Yankunytjatjara Lands. Ahava Energy has conducted seismic exploration in PEL 499 during 2008 and 2009.

PEL 138 is located within the border of the Lands. Ahava Energy holds licence applications for a further two licences on the Lands, PELAs 147 and 148. Licence areas 138, 147 and 148 are located in the south-central and south-eastern region of the Ananngu Pitjantjatjara Yankunytjatjara Lands.

Ahava Energy intends to commence geophysical exploration activities initially in PEL 138, and pending the success of its program, subsequently in PELAs 147 and 148 (once granted) to identify and describe potential hydrocarbon prospects. Ahava Energy will not undertake any geophysical operations in the active Mintabie opal mining area (exclusion area is defined in Mintabie).

2.3 Location

The Officer Basin covers 410,000 km^2 of land spanning areas of Western Australia and South Australia. PEL 138 and PELAs 147 and 148 are located completely within the South Australian section of the Officer Basin and within the south-central and south-eastern corner of the Ananngu Pitjantjatjara Yankunytjatjara Lands (see Figure 2.1). The licence areas extend southwest from Mintabie and cover 6,264 km^2, 7,860 km^2 and 9,393 km^2 respectively. The nearest major townships to Mintabie (located within PEL 138) include Cooper Pedy (274 km south-southeast), Alice Springs (450 km north) and Adelaide (1,100 km south-southeast).

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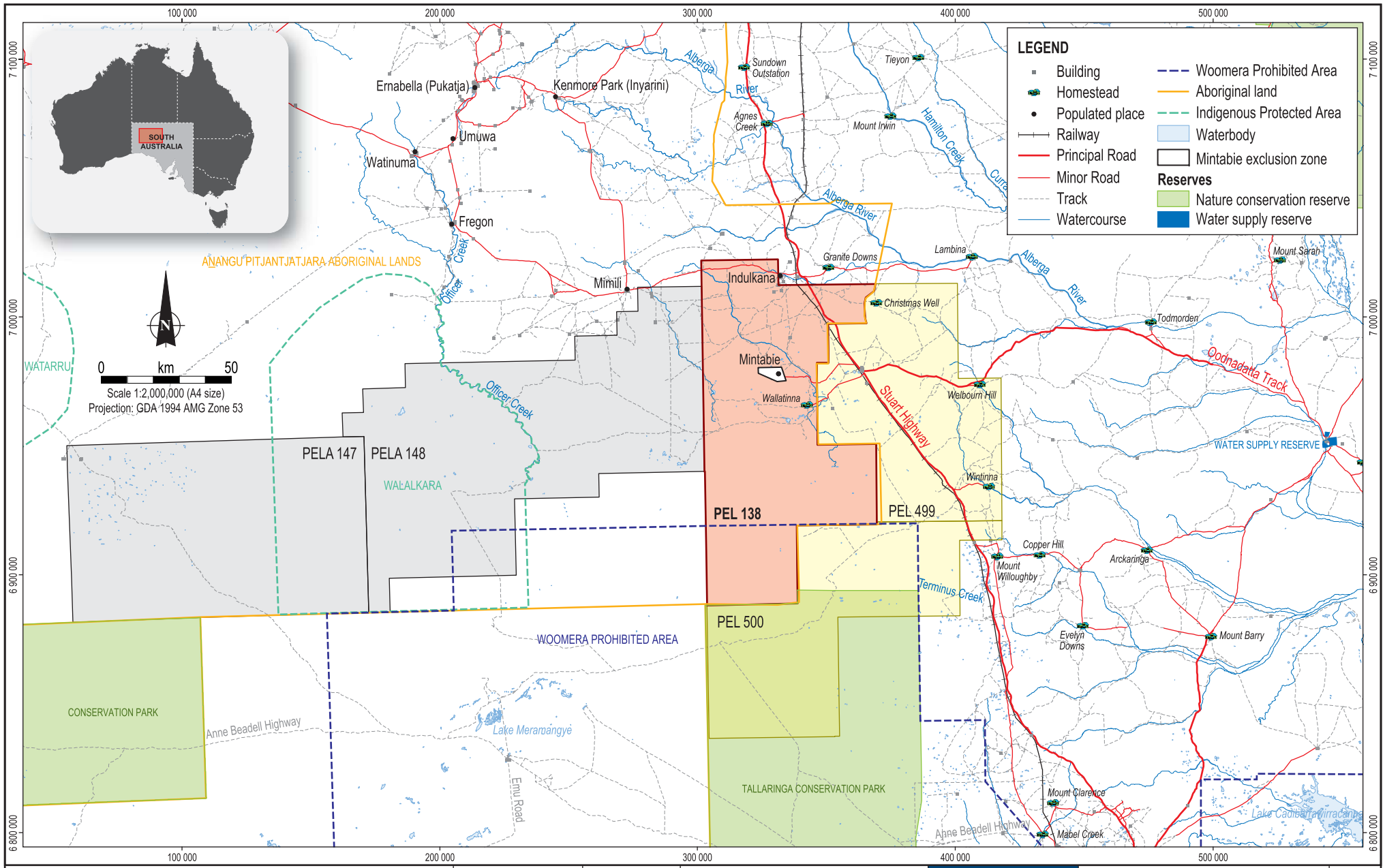
PELA 147 and PELA 148 encompass part of the Walalkara Indigenous proclaimed area (IPA). The Walalkara IPA is an area of Indigenous-owned land where the Traditional Owners have entered into an agreement with the Australian Government to protect and enhance the biodiversity of the areas of unique conservation significance through traditional management techniques (DEWHA, 2009).

Ananngu Pitjantjatjara Yankunytjatjara Land Management Unit (APYLMU) is currently working with Traditional Owners southeast of Mimili to undertake planning and consultation, to evaluate the potential of declaring an Indigenous Protected Area. It is proposed that the IPA would be called Sandy Bore Indigenous Protected Area, it adjoins the eastern border of the Walalkara IPA, and covers approximately 7,000 $km^{2.}$ APYLMU has been working with Traditional Owners in the area for several years now to help manage both traditional and contemporary land management issues.

The two mains reasons that Traditional Owners have shown an interest in the IPA program are that they would like to protect the natural and cultural values of their area from impacts such as cattle grazing, and that they would like to be able to access funding to undertake cultural and environmental management activities. The area has significant environmental and cultural value and would be a valuable contribution to the National Reserve System through the Indigenous Protected Area (APYLMU, 2009).

Portions of PELs 138, 500 and PELA 148 intersect the Woomera Prohibited Area. Regulation 35 of the *Defence Force Regulations 1952* stipulates that permission from the Commonwealth Department of Defence is required to enter this area.

There are no proclaimed parks or reserves within the proposed seismic survey area. Two conservation parks, Mamungari and Tallaringa occur on the southern boundaries of PELA 147 and PEL 138 respectively (Figure 2.1). No seismic exploration will occur within these conservation parks.



	coffey natural systems	Job No: 5038 File Name: 5038_01_F02.01_HB	Ahava Energy Environmental Impact Report	AHAVA ENERGY	Location of Ahava Energy's PELs in the Anangu Pitjantjatjara Yankunytjatjara Lands Region of the Officer Basin	Figure No: 2.1

2.4 Summary of Petroleum Exploration History

Initial interest in the Officer Basin region was largely focused on the likely mineral potential of the area. Early interest in petroleum prospects in the Officer Basin was discouraged by government geologists in the 1940s who suggested that the Precambrian rocks found in the northwest of South Australia were unlikely to support producing oilfields.

Petroleum exploration in the Officer Basin largely began in the 1960s, initially by Exoil, Conoco and Outback Oil. Aeromagnetic, gravity and seismic surveys were conducted throughout the 1960s and early 1970s with several stratigraphic and wildcat wells being drilled. However, by the mid 1970s exploration of petroleum potential in the region was increasingly limited as access to the area became progressively more restricted for the then Mines Department and petroleum companies.

Within the Anangu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin petroleum exploration was affected as changes to legislation and policy relating to Aboriginal land rights in the area continually deferred exploration programs.

In 1979 renewed exploration of the region was encouraged by the intersection of significant oil bleeds in the Byilkaoora 1 stratigraphic well, in the northeast Officer Basin. This discovery, as well as higher world oil prices in the early 1980s, spurred further petroleum exploration. Throughout the 1980s exploration including a seismic survey within the southern Anangu Pitjantjatjara Yankunytjatjara Lands (then the Pitjantjatjara Lands) was carried out by Amoco and Comalco, which significantly improved understanding of the north eastern Officer Basin.

The Amoco seismic surveys in the eastern Officer Basin was granted permission to conduct petroleum operations on the Lands by Anangu Pitjantjatjara in accordance with the terms and conditions detailed in an Access and Cooperation Agreement between Anangu Pitjantjatjara and Amoco, entered into on 1 November 1985. The terms and condition of entry into the Lands included:

- Ensuring all personnel and contractors entering the Lands were in possession of appropriate permits and to regularly supply updated lists of personnel who have been issued with permits and identification cards to the contractor's representative.
- Ensuring all personnel and contractors stay within seismic tracks that have been screened and cleared (for sites of cultural heritage sites).
- Details of cultural heritage clearance requirements.
- Details of environmental guidelines for conducting seismic operations on the Lands.
- Details of the prohibition of alcohol on the Lands.
- Details of the removal of employees if the terms and conditions of the Access and Cooperation Agreement were breached.
- Requirements of all personnel and contractors to undergo inductions in Aboriginal culture prior to entering the Lands.

The then Mines Department continued to encourage interest in having the Anangu Pitjantjatjara Yankunytjatjara Lands opened to mineral and petroleum searches and in late 1991 released a

data package titled *Geology and mineral potential of the Pitjantjatjara*. The Ananngu Pitjantjatjara Yankunytjatjara community was noted to prefer oil exploration over mineral exploration on their Lands (O'Neill, 1997).

The then Mines Department in conjunction with the Australian Geological Survey Organisation conducted seismic surveys in the unexplored Pitjantjatjara and Maralinga Lands in the eastern Officer Basin in late 1993. This information was reviewed in conjunction with past data and it was concluded that considerable potential for undiscovered hydrocarbons existed in the Officer Basin (O'Neil 1997).

Most recently two seismic surveys were conducted in the region by Officer Basin Energy comprising the Maralinga Lands Seismic Survey 1 (2007/2008) and 2 (2008/2009).

2.5 Petroleum Resource Rationale

The Neoproterozoic and Cambrian rocks of the eastern Officer Basin are well endowed with oil shows. Geochemical studies have signalled the existence of at least four petroleum systems within the region.

Oil shows have been recorded in wells drilled for both oil and minerals, only five of which exceed 2,000 m depth. The presence of Proterozoic oil in Cambrian reservoirs is proof of the generation and migration of oil in this basin. Good sandstone reservoirs and seals are numerous within the region and significant areas of the basin indicate the necessary maturity for oil generation. Potential traps range from compressive, extensional, salt related to stratigraphic (Tingate and McKirdy, 2003).

Currently no commercial oil and gas production exists in the Officer Basin. The commencement of oil production within the region would help meet increasing oil demand in South Australia and interstate.

3. LEGISLATIVE FRAMEWORK

This chapter details the procedural and legislative requirements for petroleum exploration activities in the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin, South Australia. Figure 3.1 and 3.2 shows a flow chart of each of the actions required to gain approval for a geophysical survey in South Australia. This EIR has been drafted in accordance with the *Petroleum Act 2000* and *Petroleum Regulations 2000* and in consultation with Primary Industries and Resource South Australia (PIRSA). Attachment A details a list of all other legislation that may be relevant to geophysical operations on the Ananngu Pitjantjatjara Yankunytjatjara Lands.

3.1 Land Use Agreement

Prior to the granting of any petroleum licenses on Aboriginal land in South Australia a land access agreement must be negotiated and signed. This agreement details the conditions to which a proponent of an activity may gain access to Indigenous land and the conduct that the proponent must display while on those lands. In general, details of the land use agreement relevant to geophysical surveys (such as seismic surveys) include details of non-negotiable exclusion zones and requirements to conduct clearance surveys to identify areas of significance to Aboriginal culture and heritage. Following the signing of a land access agreement between relevant parties PIRSA can authorise and issue the relevant petroleum exploration licences (PEL).

The land access agreement (in this case called, a Conjunctive Land Access Agreement) between Ananngu Pitjantjatjara Yankunytjatjara and Ahava Energy was authorised in 14 July 2009 with PEL 138 granted by PIRSA on 16 July 2009.

The land access agreement applies to PEL 138 and PELA 147 and 148. However, section 7 of the *Ananngu Pitjantjatjara Yankunytjatjara Land Rights Act 1981* requires that Ananngu Pitjantjatjara Yankunytjatjara must first obtain consent from the Traditional Owners prior to finalising any agreement in respect of those lands. This consultation process has already occurred for PEL 138 but not yet for PELA 147 and 148.

Consequently the agreement has been drafted so that it applies immediately to PEL 138 and provides for the section 7 process to be undertaken for the areas of PELA 147 and 148. Once consultation has occurred, and if consent is given, the land access agreement contains a mechanism whereby the areas of PELA 147 and 148 are “brought into” the agreement and its terms apply to those areas.

3.2 Petroleum Act and Regulations

Following the issuing of a PEL, the *Petroleum Act 2000* and the *Petroleum Regulations 2000* provide as the primary legislation regulating petroleum exploration activities in South Australia. The primary objectives of this legislation include:

- To protect the natural, cultural, heritage and social aspects of the environment from risks associated with activities governed by the *Petroleum Act 2000*.
- To provide for constructive consultation with stakeholders, including effective reporting of industry performance to stakeholders.

- To provide security of title for petroleum, geothermal energy, and other resources governed by the Act and pipeline licenses.

The *Petroleum Act 2000* and associated regulations do not prescribe generic management strategies for regulated activities, but allows the licensee (in this case, Ahava Energy) to work collaboratively with the regulatory authorities, the community and other interested stakeholders to formulate a set of performance standards relevant to the regulated activity in the area of interest. The regulated activity (in this case, seismic surveys) is essentially self-regulated by the proponent, using the collaboratively sought performance standards as detailed in an approved SEO, with the regulating agencies providing due diligence review where appropriate.

An exploration licence as defined by Part 4, Division 3(21) of the *Petroleum Act 2000* allows a licensee to:

- Explore for regulated resources.
- Establish the nature and extent of regulated resources.
- Establish the feasibility of production and appropriate production techniques.

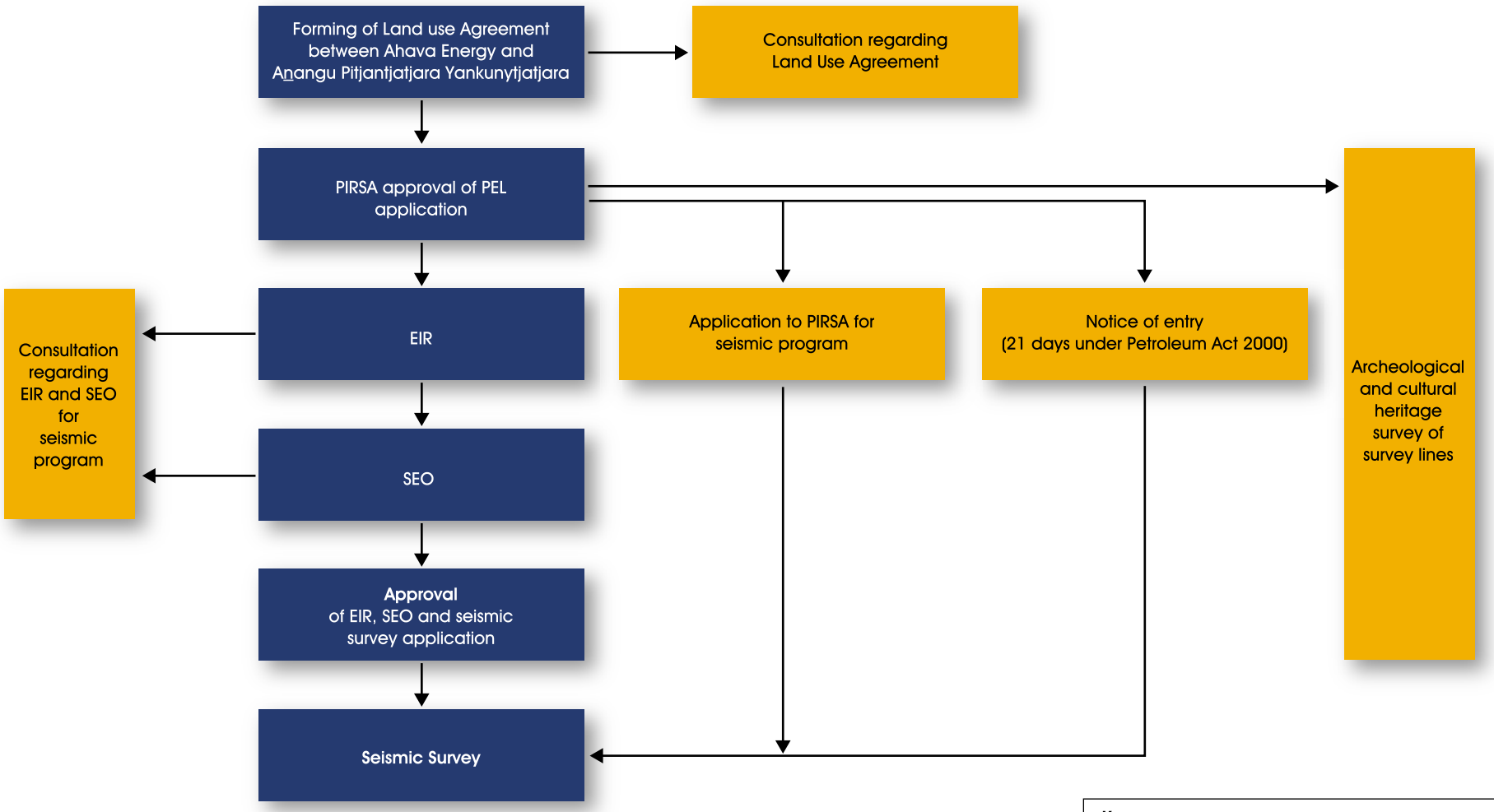
A regulated resource as defined by Part 1 of the *Petroleum Act 2000* is:
- A naturally occurring underground accumulation of a regulated substance.
- A source of geothermal energy.
- A natural reservoir.

A regulated substance as determined under Part 1 of the *Petroleum Act 2000* includes:

- Petroleum.
- Hydrogen sulfide
- Nitrogen.
- Helium.
- Carbon dioxide.
- Any substance declared by regulation to be a substance to which this Act applies.

A regulated activity as defined by Part 3 Section 10(1) of the *Petroleum Act 2000* includes:

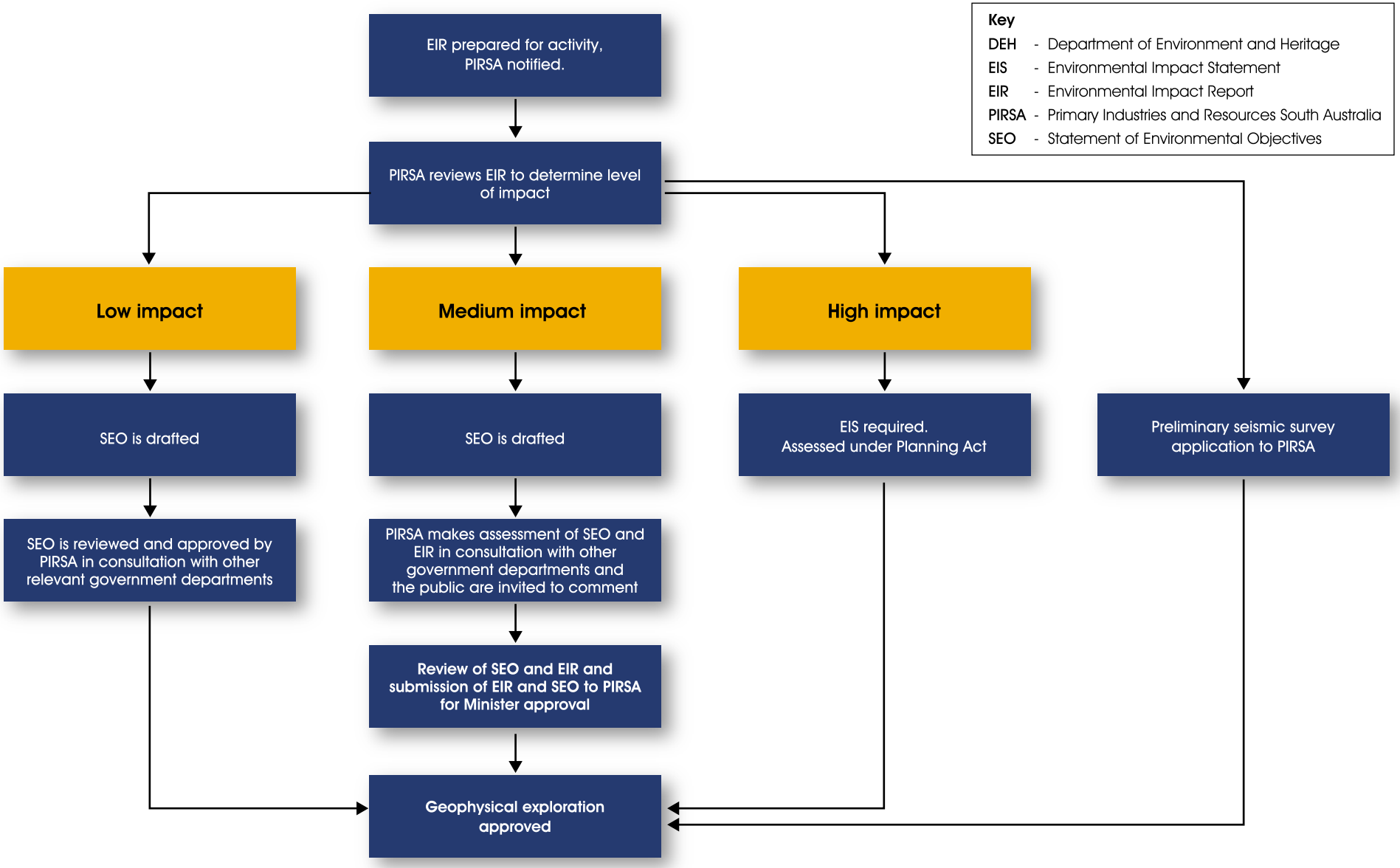
- Exploration for petroleum or another regulated resource.
- Operations to establish the nature and extent of a discovery of petroleum or another regulated resource, and to establish the commercial feasibility of production and the appropriate production techniques.
- Production of petroleum or other regulated substance.
- Utilisation of a natural reservoir to store petroleum or other regulated substance.
- Production of geothermal energy.
- Construction of a transmission pipeline for carrying petroleum or other regulated substance.
- Operation of a transmission pipeline for carrying petroleum or another regulated substance.



Key

EIR - Environmental Impact Report
PEL - Petroleum Exploration Licence
PIRSA - Primary Industries and Resources South Australia
SEO - Statement of Environmental Objectives

	coffey natural systems	Job No: 5038 File Name: 5038_01_F03.01_HB	Ahava Energy Environmental Impact Report	AHAVA ENERGY	Actions required to approve geophysical exploration in South Australia	Figure No: 3.1



	coffey natural systems	Job No: 5038 File Name: 5038_01_F03.02_HB	Ahava Energy Environmental Impact Report	AHAVA ENERGY	Approval of EIR and SEO for geophysical exploration in South Australia	Figure No: 3.2

3.2.1 Statement of Environmental Objectives

A requirement of the *Petroleum Act 2000* and Petroleum Regulations is that regulated activity under a licence can only be carried out once a SEO has been developed and approved. The Petroleum Regulation No. 12 details that an SEO must contain:

- Environmental objectives relating to the relevant activity.
- Criteria to be used to measure and assess the achievement of the environmental objectives.

The SEO is effectively the licensee's operating environmental management system for a defined area and is formulated from information provided in the EIR. The EIR is prepared by the licensee and contains an assessment of the potential impacts and the mitigation and management requirements to ensure that acceptable levels of impacts are maintained.

PIRSA, Ecos, Santos, and Officer Basin Energy have previously developed generic SEOs for the following regulated activities. This EIR has been drafted in consideration of the following SEOs and their accompanying EIRs:

- Statement of Environmental Objectives: geophysical operations in the Officer Basin, South Australia (Officer Basin Energy Pty Ltd, 2008).
- Statement of Environmental Objectives for geophysical operations in the Otway Basin, South Australia (Kane, 2007).
- Statement of Environmental Objectives: geophysical operations in the Arckaringa Basin, South Australia (Ecos, 2007).
- Statement of Environmental Objectives: geophysical operations in the Cooper Basin, South Australia (Santos, 2006).
- Statement of Environmental Objectives for seismic operations in the Cooper and Eromanga Basins, South Australia (Cockshell, 1998) (superseded by Santos 2006).

3.2.2 Environmental Impact Report

Under the *Petroleum Act 2000* and Petroleum Regulations, the licensee must prepare an EIR for any regulated activity. The Act states that the EIR must be prepared in accordance with the Petroleum Regulations.

The *Petroleum Act 2000* details that an EIR must:

- Take into account cultural, amenity and other values of Aboriginal and other Australians insofar as those values are relevant to the assessment.
- Take into account risks inherent in the regulated activity to the health and safety of the public.
- Contain sufficient information to make possible an informed assessment of the likely impacts of the activities on the environment.

Part 3(10) of the Petroleum Regulations sets out the information and material required in an EIR and include:

a) A description of the regulated activity to be carried out under the licence (including their location).

b) i) A description of the specific features of the environment that can reasonably be expected to be affected by the activities, with particular reference to the physical and biological aspects of the environment and existing land uses.

ii) An assessment of the cultural values of Aboriginal and other Australians which could reasonably be foreseen to be affected by the activities in the area of the licence, and the public health and safety risks inherent in those activities (insofar as these matters are relevant in the particular circumstances).

iii) if required by the minister – a prudential assessment of the security of natural gas supply.

c) A description of the reasonably foreseeable events associated with the activities that could pose a threat to the relevant environment, including:

i) Information on the following:

- Events during the construction phase (if any), the operational stage and the abandonment stage.
- Events due to atypical circumstances (including human error, equipment failure or emissions, or discharges above normal operating levels).

ii) Information on the estimated frequency of these events.

iii) An explanation of the basis on which these events and frequencies have been predicted.

d) An assessment of the potential consequences of these events on the environment, including –

i) Information on the following:

- The extent to which these consequences can be managed or addressed.
- The action proposed to be taken to manage or address these consequences.
- The anticipated duration of the consequences.

ii) An explanation on which these consequences have been predicted.

e) A list of all owners of the relevant land.

f) Information on any consultation that has occurred with the owner of the relevant land, any Aboriginal groups or representatives, any agency or instrumentality of the Crown, or any other interested persons or parties, including specific details about relevant issues that have been raised and any response to those issues but not including confidential information.

3.3 Assessment of SEO and EIR

Following the submission of the EIR and draft SEO to PIRSA, an assessment of the EIR is made by PIRSA using a set of publicly developed environmental impact classification criteria. The assessment classifies the project in terms of environmental impact into low, medium or high impact. This assessment by PIRSA is made in consultation with a range of other relevant government agencies and may include Planning SA, the Department for Environment and Heritage (DEH), the Department of Water, Land and Biodiversity Conservation (DWLBC) and the Environmental Protection Agency (EPA). The level of impact then determines the consultation

requirements prior to the final approval of the SEO. The following details the levels of consultation required for each of the impact classifications:

- **Low impact activities** – The EIR and SEO are subject to a process of internal review by relevant state government agencies (that may include PIRSA, Planning SA, DEH, DWLBC and EPA) prior to approval.
- **Medium impact activities** – The EIR and SEO undergo a similar internal review by relevant state government agencies as well as a period of public consultation. During public consultation, the public is invited to make comment on the EIR and SEO. There is no minimum statutory consultation period. However timeframes generally range between 28 and 42 days.
- **High impact activities** – High impact activities are referred to Planning SA for assessment under the *Development Act 1993*, and require an environmental impact assessment (EIA).

4. EXISTING ENVIRONMENT

The following section describes the climate, biophysical environment, social environment, Aboriginal cultural heritage, land use and the socio-economic environment of the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin, where Ahava Energy propose to perform petroleum exploration activities.

Ahava Energy's PEL and PELAs occur in the south-central and south-eastern regions of the Lands and cover an area of approximately 23,517 km^2. The Ananngu Pitjantjatjara Yankunytjatjara Lands contain a variety of soil types, rock types, and landforms including the Musgrave and Mann Ranges to the north and the extensive dune fields of the Great Victoria Desert in the south, where Ahava Energy's PEL(A)s are located. The region's topography ranges from 1400 m in the north at the Everard Ranges to less than 200 m in the south of the Ananngu Pitjantjatjara Yankunytjatjara Lands (Robinson *et al*. 2003).

Publically available records of listed flora and fauna on the Ananngu Pitjantjatjara Yankunytjatjara Lands are limited with the majority of records collected during the South Australia Department of the Environment and Heritage's (DEH) Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands (Robinson *et al.* 2003). Table 4.1 to 4.4 lists flora and fauna species listed under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) and State *National Parks and Wildlife Act 1972* that have been recorded or may occur or have suitable habitat within in the region of Ahava Energy's PEL(A)s.

4.1 Climate

The Ananngu Pitjantjatjara Yankunytjatjara Lands are characterised by hot to extremely hot summers and dry mild winters. There are occasional summer storms in the north of the region. However there is generally little seasonality to the south of the Ananngu Pitjantjatjara Yankunytjatjara Lands where Ahava Energy's PEL(A)s are situated. There closest Bureau of Meteorology (BOM) weather recording stations near to Ahava Energy's PEL(A)s are at Marla (20 km to the east of PEL 138) and Ernabella (Pukatja) (120 km to the north of PEL 138). The long term data from both of these stations show similar trends. However, the Ernabella (Pukatja) station was decommissioned in 1983 so all recent data is from the Marla station (BOM, 2009).

Based on data collected at Marla, the mean annual temperature for the region is 29°C, ranging from a mean maximum temperature of 36°C to a mean minimum temperature of 21°C in summer, while winter temperatures range from a mean maximum of 20°C to a mean minimum of 5°C. Temperatures in the region can reach extremes, for example, in arid zones frosts are not uncommon during winter, with overnight lows of -4°C having been recorded. Similarly during summer, extremely high temperatures can be reached during the day; temperatures up to 49°C have been recorded.

Typical of arid environments rainfall in the region is low and unpredictable, with long dry periods and occasional summer flooding events. The mean annual rainfall recorded at Marla is 218 mm. The majority of rainfall occurs between November and March. Evaporation rates are approximately 3,300 to 3,800 mm annually, exceeding annual rainfall (NRM, 2009).

Wind speed is generally low, with a mean annual wind speed of 11 km/hr recorded for Marla. Wind speeds are generally consistent over the year ranging from a mean of 12 km/hr during the summer to a low mean wind speed of 8 km/hr during winter afternoons. Summer winds tend to the south throughout the day. Winter wind directions are variable, but tend to be northerly.

4.2 Social Environment

The PEL presently held by Ahava Energy is owned and inhabited in the main by Ananngu. The administrative centre of the Lands is Umuwa and the main communities are Pukatja (Ernabella), Amata, Iwantja (Indulkana), Mimili and Pipalyatjara. There are several other smaller communities and occupied homelands on the Lands.

The *Ananngu Pitjantjatjara Yankunytjatjara Land Rights Act 1981* provides the legislative head of power to establish Ananngu Pitjantjatjara Yankunytjatjara as a body corporate and sets out its powers. The Act also describes the requirements for consultation with Traditional Owners prior to certain decisions being made by the Executive Board. (see Section 5.1.1, Planning).

4.2.1 Socio-economic Environment

Much has been written about the poor socio-economic situation of the Ananngu Pitjantjatjara Yankunytjatjara Lands, some of which is attributed to the challenges of adjusting from a largely-traditional lifestyle to the influence of modern society. Petroleum and mineral exploration has been welcomed by many of the Traditional Land Owners who have expressed hope that exploration will lead to petroleum development and result in the creation of employment and economic opportunities and an overall improvement in the social environment of the Ananngu Pitjantjatjara Yankunytjatjara Lands.

It is believed that Ananngu have lived on the area defined as the Ananngu Pitjantjatjara Yankunytjatjara Lands for more than 20,000 years. It is understood Ananngu first came into contact with European settlers in the latter part of the nineteenth century, although, according to anthropologists there are many ‘first contact’ stories from Ananngu still living today (Australian Cultural Heritage Management (ACHM), 2009).

Prior to European contact, it is believed Ananngu lifestyle was that of hunter-gatherer. Like other Indigenous peoples, the Ananngu had traditions of spirituality and healing and undertook activities of trade and land management. Many of the traditional elements of daily life continue in the Ananngu’s current way of life, along with many more modern European practices.

Ananngu culture is described as communal, rather than individual (ACHM, 2009). Decision-making occurs by consensus of both men and women elders within communities. The Ananngu Pitjantjatjara Yankunytjatjara Executive Board has administrative and decision-making powers on behalf of Ananngu across all of the Ananngu Pitjantjatjara Yankunytjatjara Lands. The Executive Board comprises elected representatives from the communities across the Ananngu Pitjantjatjara Yankunytjatjara Lands.

The Australian Bureau of Statistics 2006 (ABS, 2006) census data identified 2,204 persons living on the Ananngu Pitjantjatjara Yankunytjatjara Lands. The census data indicated that the population on the Lands has declined from 2,629 in 2002. However, the local population can vary significantly depending on cultural events, time of year, season or other circumstances such as sporting events and traditional occasions. Participation in population and other data-gathering

initiatives varies depending on migration to and from the Ananngu Pitjantjatjara Yankunytjatjara Lands, and numeracy and literacy efficacy. According to the ABS, there were an equal proportion of males and females living on the Ananngu Pitjantjatjara Yankunytjatjara Lands in 2006. The total number of families living on the Lands in 2006 was 496.

The 2006 population was relatively young, with 26.9% aged between 0 to 14 years. Only 21.9% of the population was aged 45 years and over. The Indigenous population accounts for 85.8% of the total population on the Ananngu Pitjantjatjara Yankunytjatjara Lands and 80.2% of the population aged 15 years and older speaks a language other than English at home. Pitjantjatjara is the first language of the Ananngu. Only 22.8% of the population aged 15 years and older have post-school qualifications.

The 2006 census data lists only 84 persons (7.8%) as formally unemployed at the time of the census. However, more than 70% are involved in unpaid work. It is widely accepted that unemployment and lack of economic opportunity of Ananngu contributes significantly to the overall poor social situation on the Ananngu Pitjantjatjara Yankunytjatjara Lands. Data on the average wage and salary earnings of Ananngu living on the Lands was not published by the ABS following its 2006 survey.

The majority of unpaid workers work as carers, either for their own children (25.2%), for other's children (16.3%) or family members and/or other members of the community (14.8%). Only 12.4% of persons undertaking unpaid work are doing so for an organisation or group.

The ABS recorded zero agricultural production on the Ananngu Pitjantjatjara Yankunytjatjara Lands, but a small beef cattle industry comprising approximately 9,200 cattle exists.

Other social challenges on the Ananngu Pitjantjatjara Yankunytjatjara Lands include:

- Inadequate housing, infrastructure and essential services.
- Poor health.
- Low employment, education and training.
- Inadequate law and order.

Petrol sniffing and alcohol abuse have caused significant social turmoil on the Ananngu Pitjantjatjara Yankunytjatjara Lands. Alcohol is now banned within the Lands and only unleaded Opal fuel is permitted. However, there is anecdotal evidence that where petrol sniffing has decreased, marijuana use has increased. Police presence has been significantly increased on the Ananngu Pitjantjatjara Yankunytjatjara Lands in recent times.

4.3 Non-Indigenous Cultural Heritage

The first European explorers investigated the Ananngu Pitjantjatjara Yankunytjatjara Lands in 1873. Since that time there has been very little European activity due to the lack of sufficient permanent water and the remoteness. Searches of the Australian heritage database, Australian heritage places inventory and Planning South Australia's heritage places database, revealed no heritage listed places within the PEL(A)s.

The initial exploratory investigations into the Ananngu Pitjantjatjara Yankunytjatjara Lands were hampered by lack of water resources. The discovery of a water hole at Ernabella (Pukatja), north of the PEL(A)s, was an important stepping stone to the brief European occupation of the Ananngu

Pitjantjatjara Yankunytjatjara Lands. Ernabella (Pukatja) then became an important base for the subsequent discovery of more permanent water. However, it became quickly clear that there was not a sufficient amount of water available to support a pastoral industry. A few stations were established on the Ananngu Pitjantjatjara Yankunytjatjara Lands, but these were focussed towards dingo scalp trading rather than pastoral activities.

Gold was discovered in the area in 1882. Due to the exaggerated claims and lack of further discoveries the industry quickly died out. Mining of opal has been ongoing in the Mintabie opal fields in the southwest of the Ananngu Pitjantjatjara Yankunytjatjara Lands since the mid 1930s with various opal exploration applications remaining around Mintabie. It is noted that geophysical exploration activities in PEL 138 will be excluded from the active Mintabie opal fields and this area is therefore not covered by the accompanying SEO. Other historical European activities carried out in the Ananngu Pitjantjatjara Yankunytjatjara Lands included bird trapping and missionary activities.

4.4 Indigenous Cultural Heritage

PELAs 147 and 148 encompass part of the Walalkara Indigenous Proclaimed Area (IPA). IPAs are areas of Indigenous owned land where the Traditional Owners have entered into an agreement with the Australian Government to protect and enhance the biodiversity of the areas of unique conservation significance through traditional management techniques (DEWHA, 2008a). Up until the 1930s land management techniques included mosaic burning of vegetation. Since then patch burning has become less frequent and less widespread leading to reduction in the available bush foods, particularly in the spinifex grasslands. Fire encourages the diversity of herbaceous species and increases the availability of edible plants (e.g. Solanum spp. for fruits and Eragrotis spp. for seed).

The Ananngu Pitjantjatjara Yankunytjatjara Lands are culturally important as an area of unbroken occupation by Ananngu. They maintain a strong connection with the land and still rely on some local flora and fauna in their everyday life (Robinson *et al.* 2001). The mulga woodlands provide Ananngu with a range of food and timber resources. Local fauna species, particularly kangaroo, malleefowl, bustards and emus, are still included in Ananngu diet. Native timbers continue to be used for firewood and tool crafting purposes and mulga woodlands are still relied on for some medicinal purposes.

Rockholes are both culturally and biologically significant to Ananngu as a permanent water supply. They are the focus of many Tjukurpa (creation stories) used by Ananngu to map out the landscape. Without this knowledge Ananngu would likely have perished in the arid environment. The story lines of Tjukurpa pass through rockhole sites so that they can be found from any point in the Ananngu Pitjantjatjara Yankunytjatjara Lands and surrounding areas. The care of rockholes continues to be culturally important today.

The continual occupation of the Ananngu Pitjantjatjara Yankunytjatjara Lands by Ananngu has led to the Ananngu Pitjantjatjara Yankunytjatjara Lands being rich in archaeological and spiritual heritage. There are many examples of Ananngu occupation throughout the landscape in the form of campsites or artefact scatter. It is an offence under the *Aboriginal Heritage Act 1988* (SA) to disturb, interfere or remove Aboriginal artefacts within South Australia.

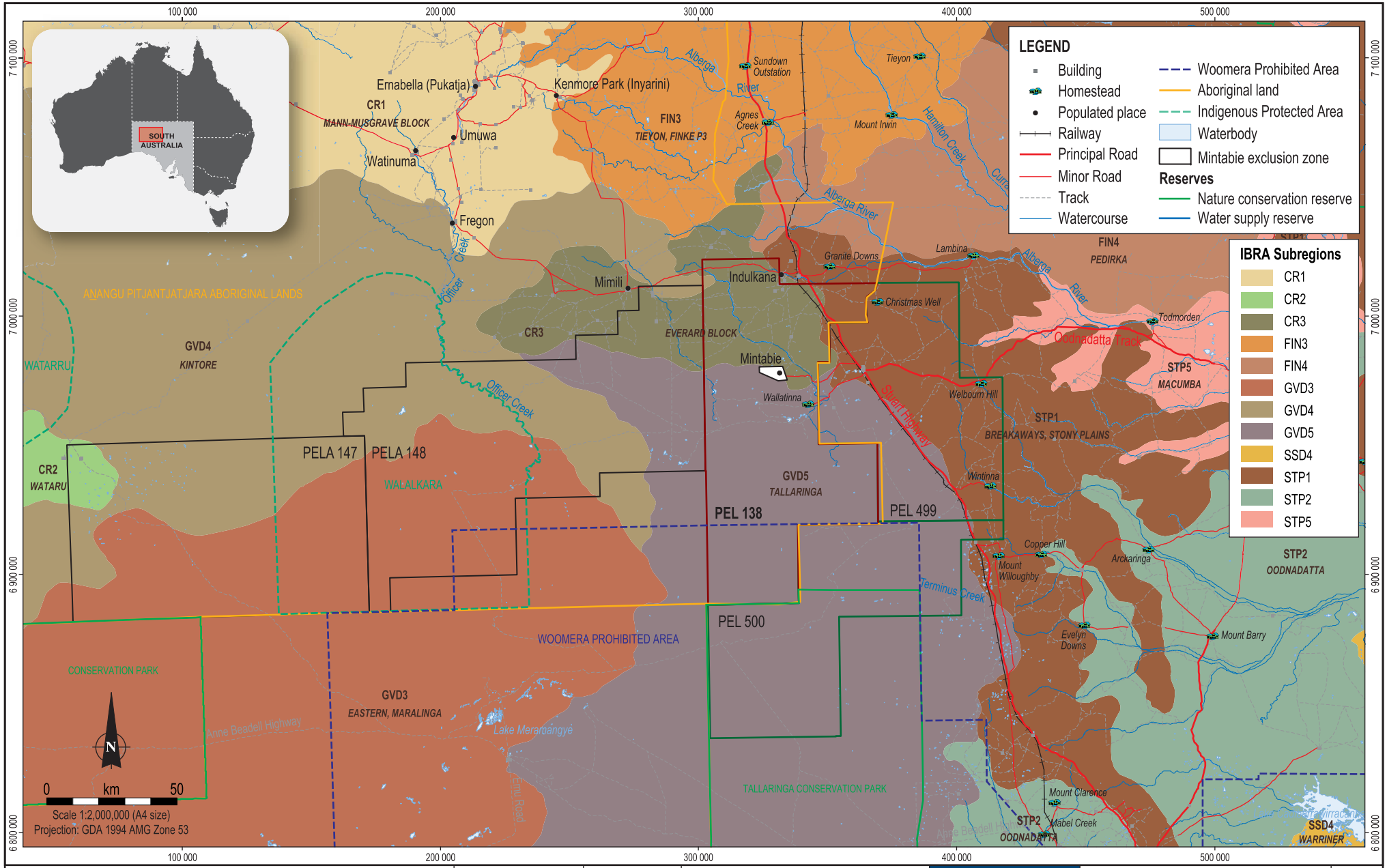
4.5 Biophysical Environment

The biogeography of PEL 138 and PELAs 147 and 148 is predominantly characterised by the Great Victoria Desert bioregion intersecting with its three sub-regions, Eastern Maralinga, Kintore and Tallaringa. To the north the PEL(A)s are also partially intersected by the Everard Block subregion of the Central Ranges bioregion (IBRA 2008).

The land systems within the two bioregions include:

- Drainage lines and floodplains.
- Dunes and sand plains.
- Salt lakes.
- Stony hills (Everard Ranges and Indulkana Ranges).
- Stony plains.

The flora, fauna and geology of each of the above land systems are discussed in the following sections.



	coffey natural systems	Job No: 5038 File Name: 5038_01_F04.01_HB	Ahava Energy Environmental Impact Report	AHAVA ENERGY	Subbioregions of the Anangu Pitjantjatjara Yankunytjatjara Lands Figure No: 4.1

4.5.1 Drainage Lines and Floodplains

All of the rivers in the PEL(A) regions are ephemeral and are short in length. Most drainage systems arise in the northeast of the Ananngu Pitjantjatjara Yankunytjatjara Lands and generally terminate on the alluvial plains north of the Great Victoria Desert in the south of the Lands. Officer Creek is one of the longest creeks in the Ananngu Pitjantjatjara Yankunytjatjara Lands and travels 150 km from Mt Woodroofe in the north of the Ananngu Pitjantjatjara Yankunytjatjara Lands to the alluvial plains in PELA 148 in the south of the Ananngu Pitjantjatjara Yankunytjatjara Lands (see Section 4.4.1, Surface Water for further details).

Drainage lines and floodplains in the region are associated with river red gum (*Eucalyptus camaldulensis* var. *obtuse)*, mixed acacia species, chenopod shrubs and grasses. Reptiles found in drainage lines and floodplains generally include purple dtella, Bynoe's gecko, perentie, and desert wall skink.

4.5.2 Dune Fields and Sand Plains

Dune fields and sand plains dominate PELA 147 and the southern half of PELA 148 within the Ananngu Pitjantjatjara Yankunytjatjara Lands. The dune formations vary from single dunes on the sand plain to closely spaced dunes which make up dune fields. Dune spacing varies from 0.5 km to 1.0 km apart but may be as close together as 0.1 km. Dune length varies from 500 m to more than 10 km. The average height of the dune systems in the dune field is approximately 10 m. Dune soils are typically deep red sands, while soils of plains and interdune swales range from sandy clays to calcareous and siliceous sands.

The dune systems and sand plains support various vegetation types dominated by desert oak, *Acacia*, *Grevillea* and *Triodia* sp. None of the species known to be present are listed under State or Commonwealth legislation.

Fauna known to live in sand plains and dune fields in the PEL(A)s include Ooldea dunnart, sandy inland mouse, red kangaroo, Wongai ningaui, spinifex hopping mouse and the southern marsupial mole. Birds include yellow-rumped thornbill, striated grass-wren, chestnut quail-thrush, rainbow bee-eater and tree martin and reptiles include common desert ctenotus, eastern two-toed slider and smooth knob-tailed gecko.

The southern marsupial mole (*Notoryctes typhlops*) is listed as Endangered under the EPBC Act. Malleefowl (*Leipoa ocellata*) occur in mallee and mulga woodlands in sandplains and occasionally dunefields. Recent reports from traditional owners suggest that malleefowl may still occur in the region of PELs 138 and 139 and they are known to occur in PELAs 147 and 148. Malleefowl are classified as vulnerable under the EPBC Act.

Twidale and Causa (2009) have detailed that seismic exploration lines on in sandy environments in the Great Victoria Desert (dating from the 1990's) are well-vegetated and although they can be seen, they must be sought. This investigation has shown that if sandy habitats are left untouched following a seismic program their ability to regenerate is high.

4.5.3 Salt Lakes (playa)

Playa lakes are limited in this region. However, a few small lakes are scattered throughout, with the majority occurring at the end of the Officer Creek in PELA 148, south of Oolarinna Hill, at the base of the Everard Ranges, during times of high rainfall.

Flora known to grow in salt lakes and salt pans within the PEL(A)s include samphire, glasswort and mulga. Fauna recorded specific to this land system includes the narrow-nosed planigale and sand goanna. None of these species are listed under State or Commonwealth legislation.

4.5.4 Stony Hills

Various rocky outcrops and granite inselbergs occur in the region. The Everard Ranges, situated in the north of PELA 148, and the Indulkana Range in the north of PEL 138 are the most significant rock formations in the PEL(A)s region. The Everard Ranges are composed of red-brown granites and rise up to 420 m above the surrounding alluvial plains.

Although smaller inselbergs exist in the Ananngu Pitjantjatjara Yankunytjatjara Lands the large granite amalgamation provides an effective source of channel run-off water and provides many moist sheltered sites and areas of refuge (Robinson *et al*. 2003).

The Everard Ranges are regarded as a significant centre of plant endemism and rarity. Some species are specifically associated with the granite rock type, e.g., red-stem button-bush and the Commonwealth EPBC-listed Mount Illbillee mintbush. Generally vegetation in the stony hills and ranges is dominated by a *Triodia* understorey with sparse emergent trees such as *Callitris* and *Acacia*.

Fauna found in the stony hills or rock outcrops of the area include the euro, the EPBC-listed black-flanked rock-wallaby, fat-tailed pseudantechinus and the introduced house mouse. Reptiles include skink, gecko, dragon, snake, snake-lizard and goannas and birds include dusky grasswren and little woodswallow. In the Everard Ranges, the most abundant birds are various species of honeyeaters.

No geophysical operations will occur in stony hill habitat as this habitat is to the north of the proposed program area and outside of the petroleum prospective area of the Officer Basin.

4.5.5 Stony Plains

The region of the PEL(A)s, particularly PEL 138, is dominated by stony plains. The plains are of alluvial origin and are generally formed as a result of erosion of the adjacent uplands. The slope is usually gentle and is steepest adjacent to the Everard and Indulkana Ranges (Robinson *et al.* 2003).

Vegetation associated with this landform includes bladder saltbush, pearl bluebush, mulga and senna.

Fauna that is known to inhabit the stony plains and surrounding low hills includes the sandy inland mouse (*Pseudomys hermannsburgensis*), stripe-faced dunnart (*Sminthopsis meacroura*), fat-tailed dunnart (*Sminthopsis crassicaudata*) and reptiles such as dragons, goannas and skinks. None of the species known to be present are listed under State or Commonwealth legislation.

4.6 Significant Flora and Fauna of Conservation Significance

Species were considered to be of conservation significance if listed nationally under Schedule 1 of the Commonwealth EPBC Act or listed in South Australia under Schedule 8 of the South Australian *National Parks and Wildlife Act 1972*.

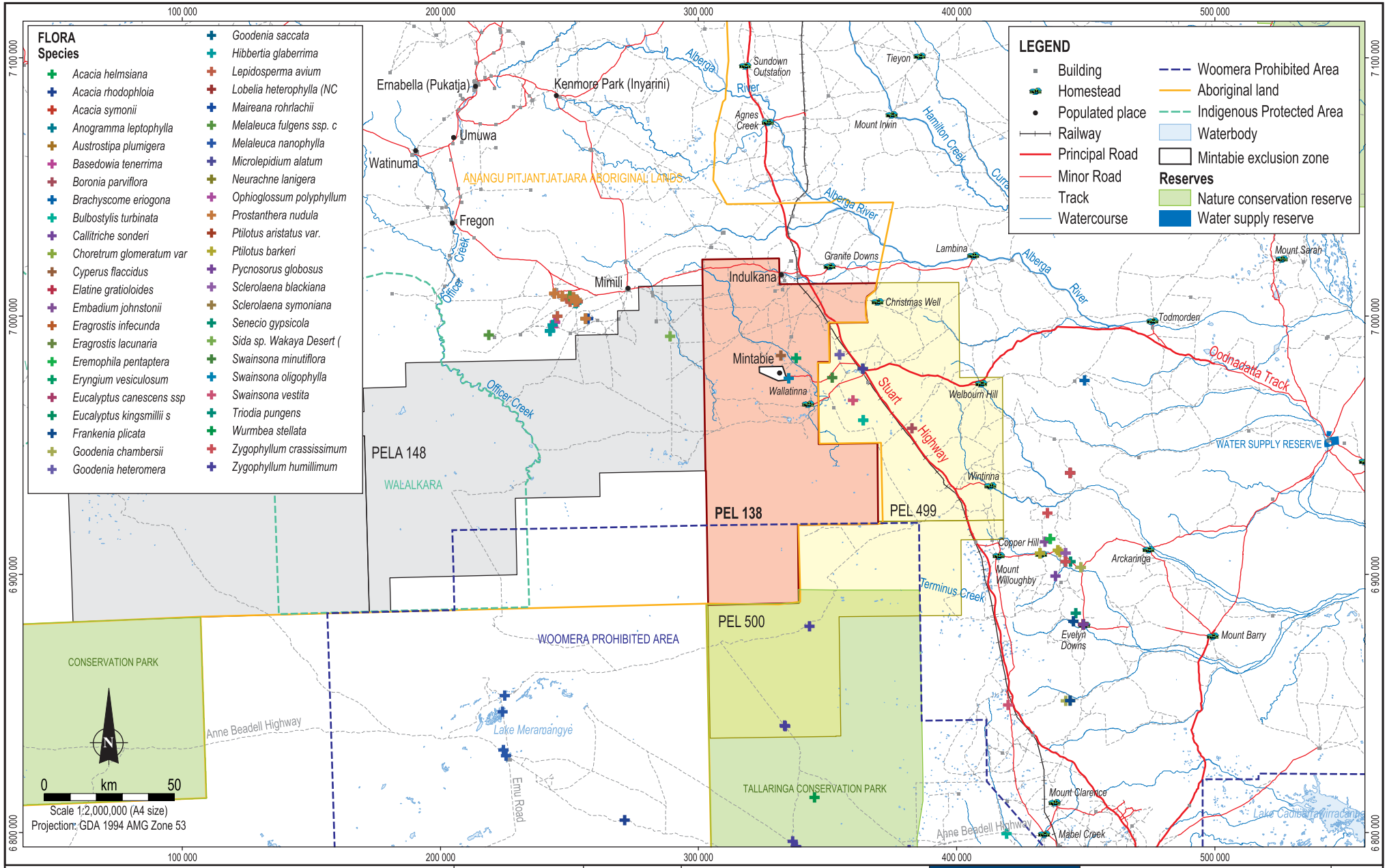
A search of the EPBC Act Protected Matters Database identified ten threatened fauna species, three flora species and five migratory species listed under the EPBC Act as potentially present within the PEL(A)s (DEWHA, 2009a). Those species listed under the EPBC Act as threatened and migratory listed flora and fauna species are listed in Table 4.1 and 4.2, along with their status and likely presence in the area during the proposed geophysical survey program. There are no EPBC Act-listed threatened ecological communities in the vicinity of the proposed exploration area. The following sections, 4.3.1 Threatened Fauna and 4.3.2 Threatened Flora, discuss the likely presence of nationally listed species in the PEL(A)s.

In addition to the EPBC Protected Matters search, A Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands South Australia between 1991 and 2001 (Robinson, A. *et al.* 2003) and a Department of Environment and Heritage (DEH) information request regarding exact locations and records of listed flora and fauna for the PELs provided information regarding listed fauna records in the region of the PEL(A)s.

In addition, the PEL(A)s regions in question have been sparsely surveyed. A Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands South Australia between 1991 and 2001 Robinson, A. *et al*. 2003) suggests targeted surveys for a number of EPBC Act and State listed species whose habitats occur in the PEL and PELA regions including the bush stone-curlew, striated grasswren, malleefowl, mulgara, ampurta, and tjakura.

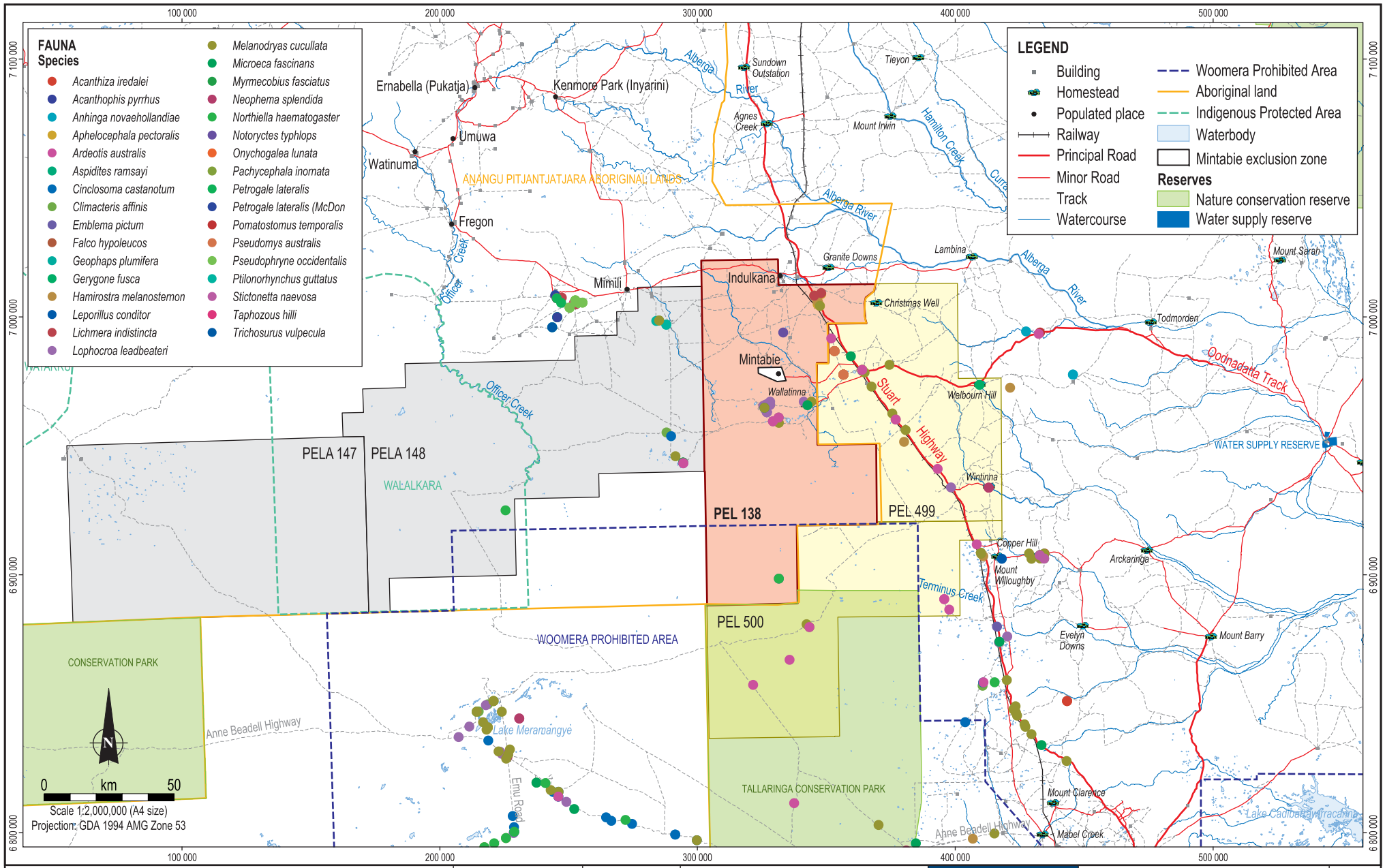
Figure 4.1 details the locations in which nationally and state listed flora and fauna have been recorded in the PEL(A)s. This information was obtained from:

- A Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands South Australia between 1991 and 2001 (Robinson, A.C. *et al.* 2003).
- An information request to Department for Environment and Heritage (DEH) regarding exact locations and records of listed flora and fauna within the region of the PEL(A)s.



coffey natural systems

Job No: 5038	Ahava Energy	AHAVA ENERGY	Locations of State and Commonwealth listed flora species in the PEL and PELAs
File Name: 5038_01_F04.02_HB	Environmental Impact Report		Figure No: 4.2



coffey natural systems	Job No: 5038	Ahava Energy	AHAVA ENERGY	Locations of State and Commonwealth listed fauna species in the PEL and PELAs	Figure No: 4.3
	File Name: 5038_01_F04.03_HB	Environmental Impact Report			

Table 4.1 Threatened species listed under the EPBC Act that may be found in the region of the PEL(A)s

Common name	Scientific name	Status	Type of presence
Flora			
Club spear-grass	*Austrostipa nullanulla*	Vulnerable	Unlikely to occur within PEL(A)s
	Basedowia tenerrima	Vulnerable	Occurs in Everard and Musgrave Ranges outside of the proposed exploration area
	Prosthanthera nudula	Vulnerable	Occurs in Everard and Musgrave Ranges outside of the proposed exploration area
Fauna			
Birds			
Slender-billed thornbill	*Acanthiza iredalei iredalei*	Vulnerable	Species or species habitat may be present within PEL(A)s
Thick-billed grasswren (eastern)	*Amytornis textilis modestus*	Vulnerable	Species or species habitat may be present within PEL(A)s
Malleefowl	*Leipoa ocellata*	Vulnerable / Migratory	Species or species habitat likely to occur within PEL(A)s
Mammals			
Mulgara	*Dasycercus cristicauda*	Vulnerable	Species or species habitat likely to occur within PEL(A)s
Ampurta	*Dasycercus hillieri*	Endangered	Species or species habitat may occur within PEL(A)s
Southern marsupial mole, Yitjarritjarri, Itjaritjari	*Notoryctes typhlops*	Endangered	Species or species habitat likely to occur within PEL(A)s
Waru, black-footed rock-wallaby (MacDonnell Ranges race)	*Petrogale lateralis MacDonnell Ranges race*	Vulnerable	Occurs in Everard and Musgrave Ranges outside of proposed exploration area
Plains rat	*Pseudomys australis*	Vulnerable	Species or species habitat may be present within PEL(A)s
Reptiles			
Great desert skink, Tjakura, Warrarna, Mulyamiji	*Egernia kintorei*	Vulnerable	Species or species habitat likely occur within PEL(A)s
Bronzeback snake-lizard	*Ophidiocephalus taeniatus*	Vulnerable	Species or species habitat may be present within PEL(A)s

Table 4.2 Migratory species listed under the EPBC Act that may be found in the region of the PELAs

Common name	Scientific name	Status	Type of presence
Flora			
Birds			
Malleefowl	*Leipoa ocellata*	Vulnerable / Migratory	Species or species habitat likely to occur within PEL(A)s
Great egret, white egret	*Ardea alba*	Migratory	Species or species habitat may occur within area
Cattle egret	*Ardea ibis*	Migratory	Species or species habitat may occur within area
Oriental plover, Oriental dotterel	*Charadrius veredus*	Migratory	Species or species habitat may occur within area
Rainbow bee-eater	*Merops ornatus*	Migratory	Species or species habitat may occur within area

Table 4.3 details the scheduled fauna species that have been recorded in the Anangu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin under both the EPBC Act and the State *National Parks and Wildlife Act 1972* that could possibly be encountered during the proposed geophysical operations.

Table 4.3 Scheduled fauna species recorded in the Anangu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin under both the EPBC Act and the State *National Parks and Wildlife Act 1972.*

Common Name	Species	EPBC Act	NPW Act
Tjakura (Great Desert Skink)	*Liopholis kintorei*	Vulnerable	Endangered
Numbat	*Myrmecobius fasciatus*	Vulnerable	Endangered
Black-footed rock-wallaby	*Petrogale lateralis (McDonnell Ranges race)*	Vulnerable	Endangered
Striated grasswren	*Amytornis striatus*		Rare
Australasian darter	*Anhinga novaehollandiae*		Rare
Chestnut-breasted whiteface	*Aphelocephala pectoralis*		Rare
Woma	*Aspidites ramsayi*		Rare
White-browed treecreeper	*Climacteris affinis*		Rare
Giant desert ctenotus	*Ctenotus grandis*		Rare
Paleface ctenotus	*Ctenotus piankai*		Rare
Desert snake-lizard	*Delma desmosa*		Rare
Painted finch	*Emblema pictum*		Rare
Grey falcon	*Falco hypoleucos*		Rare
Peregrine falcon	*Falco peregrinus*		Rare
Black-breasted buzzard	*Hamirostra melanosternon*		Rare
Scarlet-chested parrot	*Neophema splendida*		Rare
Scarlet-chested parrot	*Neophema splendida*		Rare
Gilbert's whistler	*Pachycephala inornata*		Rare
Desert death adder	*Acanthophis pyrrhus*		Vulnerable

Common Name	Species	EPBC Act	NPW Act
Australian bustard	*Ardeotis australis*		Vulnerable
Malleefowl	*Leipoa ocellata*	Vulnerable	Vulnerable
Greater stick-nest rat	*Leporillus conditor*	Vulnerable	Vulnerable
Marsupial mole (Itjara Itjara)	*Notoryctes typhlops*	Endangered	Vulnerable
Princess parrot	*Polytelis alexandrae*	Vulnerable	Vulnerable
Plains rat	*Pseudomys australis*	Vulnerable	Vulnerable
Orange-crowned toadlet	*Pseudophryne occidentalis*		Vulnerable
Freckled duck	*Stictonetta naevosa*		Vulnerable

Source: DEH SA database search.

Table 4.4 details the scheduled flora species that have been recorded in the Anangu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin under both the EPBC Act and the State *National Parks and Wildlife Act 1972* that could possibly be encountered during the proposed geophysical operations.

Table 4.4 Scheduled flora species recorded in the Anangu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin under both the EPBC Act and the State *National Parks and Wildlife Act 1972.*

Common Name	Species	EPBC Act	NPW Act
Helm's wattle	*Acacia helmsiana*		Rare
Minni ritchi	*Acacia rhodophloia*		Rare
Symon's wattle	*Acacia symonii*		Rare
Annual fern	*Anogramma leptophylla*		Rare
	Austrostipa plumigera		Rare
	Basedowia tenerrima	Vulnerable	Rare
Swamp boronia	*Boronia parviflora*		Rare
	Brachyscome eriogona		Rare
	Bulbostylis turbinata		Rare
Matted water starwort	*Callitriche sonderi*		Rare
Yellow-flower sour-bush	*Choretrum glomeratum var. chrysanthum*		Rare
Flaccid flat-sedge	*Cyperus flaccidus*		Rare
Waterwort	*Elatine gratioloides*		Rare
Johnston's slipper-plant	*Embadium johnstonii*		Rare
Barren cane-grass	*Eragrostis infecunda*		Rare
Purple love-grass	*Eragrostis lacunaria*		Rare
	Eremophila pentaptera		Rare
Prostrate blue devil	*Eryngium vesiculosum*		Rare
Beadell's mallee	*Eucalyptus canescens ssp. beadellii*		Rare
Kingsmill's mallee	*Eucalyptus kingsmillii ssp. alatissima*		Rare
	Goodenia chambersii		Rare
Spreading goodenia	*Goodenia heteromera*		Rare
Flinders ranges goodenia	*Goodenia saccata*		Rare

Common Name	Species	EPBC Act	NPW Act
Central Australian Guinea-flower	*Hibbertia glaberrima*		Rare
Central Australian rapier-sedge	*Lepidosperma avium*		Rare
	Lobelia heterophylla (NC)		Rare
Rohrlach's bluebush	*Maireana rohrlachii*		Rare
Wrinkled honey-myrtle	*Melaleuca fulgens ssp. corrugata*		Rare
Dwarf-leaf honey-myrtle	*Melaleuca nanophylla*		Rare
Woolly mulga-grass	*Neurachne lanigera*		Rare
Large adder's-tongue	*Ophioglossum polyphyllum*		Rare
Barker's mulla mulla	*Ptilotus barkeri*		Rare
Black's bindyi	*Sclerolaena blackiana*		Rare
Gypsum groundsel	*Senecio gypsicola*		Rare
	Sida sp. Wakaya Desert (C.Dunlop 1984)		Rare
	Swainsona oligophylla		Rare
Gummy spinifex	*Triodia pungens*		Rare
Star nancy	*Wurmbea stellata*		Rare
Thick twinleaf	*Zygophyllum crassissimum*		Rare
Small-fruit twinleaf	*Zygophyllum humillimum*		Rare
	Frankenia plicata	Endangered	Vulnerable
	Microlepidium alatum	Vulnerable	Vulnerable
Mount illbillee mintbush	*Prostanthera nudula*	Vulnerable	Vulnerable
	Ptilotus aristatus var. eichlerianus		Vulnerable
Drumsticks	*Pycnosorus globosus*		Vulnerable
Symon's bindyi	*Sclerolaena symoniana*		Vulnerable
Small-flower swainson-pea	*Swainsona minutiflora*		Vulnerable
	Swainsona vestita		Vulnerable

Source: DEH SA database search.

4.6.1 Significant Fauna Species

This section details the EPBC-listed fauna species that have been recorded or may be encountered during geophysical operations in the PEL(A)s and a description of the likelihood of geophysical operations presenting a significant impact to these species.

Slender-billed thornbill (western) *(Acanthiza iredalei iredalei)*

The slender-billed thornbill (western) is listed under the Commonwealth EPBC Act as vulnerable. This species is distributed across the arid and semi-arid regions of southern Western Australia and south-western South Australia (DEWHA, 2000a). The extent of occurrence is estimated at 400 000 km^2 (DEWHA, 2000a).

The slender-billed thornbill (western) commonly inhabits chenopod shrublands dominated by samphires or *Maireana* and *Atriplex* associations (Baxter and Paton, 1998; Hall, 1974; Matthew, 1994; Recher and Davis, 2000 cited in DEWR, 2007d). The slender-billed thornbill has also been

noted in areas in close proximity to salt lakes (Hall, 1974; Storr, 1985a; 1986; Whitlock, 1910 cited in DEWR, 2007d). The Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands did not identify this species within the project area. However, the species could be present where appropriate chenopod shrubland occurs. Given the limited amount of chenopod shrublands in the PEL(A)s, the mobility of the species and the temporary impact of seismic exploration it is unlikely that this species will be impacted by the proposed geophysical survey program.

Thick-billed grass wren (*Amytornis textilis modestus*)

The thick-billed grass wren is listed under the Commonwealth EPBC Act as vulnerable. Although once occurring in a range of habitats (NPWS, 2002), the eastern subspecies of the thick-billed grass wren is now restricted to chenopod shrublands dominated by *Maireana* and *Atriplex* spp. (Garnett and Crowley, 2000). The species is regarded as shy and reclusive and has not been formally recorded within any conservation reserves (Neagle, 2003). The Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands and DEH records have not confirmed this species from the Great Victoria Desert Bioregion.

This species has most commonly been associated with the Stony Plains Bioregion which sits east and northeast of the Officer Basin. The species is sedentary or resident (NPWS, 2002) and is thus unlikely to move away from the area if disturbed. Large dense shrubs are important shelter and nesting sites (NPWS, 2002) and removal of this habitat during exploration or mining activity is likely to severely impact individuals of this species. Predation by feral cats is also considered a threat to the thick-billed grass wren (NPWS, 2002).

Given the limited amount of chenopod shrublands in the PEL(A)s, and the temporary impact of geophysical survey program, it is unlikely that the proposed geophysical survey in the PEL(A)s will affect this species. The clearance of large dense shrubs will minimised where possible by rerouting seismic tracks and using existing tracks.

Malleefowl (*Leipora ocellata*)

The malleefowl is listed as vulnerable both nationally and in South Australia. Malleefowl occur in a wide range of areas across the Ananngu Pitjantjatjara Yankunytjatjara Lands at very low population densities. Malleefowl live in the sand plain, dune country with mulga and mallee scruband woodland. The malleefowl's habitat is highly susceptible to wildfire and has been substantially fragmented over the past few decades. Their eggs are preyed upon by foxes, and chicks and adults may be taken by foxes, cats, dingoes and other native predators (DEWHA, 2000c). While the frequency of such predation may be relatively low (compared with other prey), it is a significant concern given the low numbers and densities of malleefowl present and the high degree of habitat fragmentation. Malleefowl occur on both the Walalkara and Watarru IPAs and mounds at Makiri have been active in the last 10 years, (north of PELA 147) (Robertson *et al*. 2003, APYLMU, pers comm).

The Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands did not find this species over most of the proposed exploration area. However, some areas that could have contained malleefowl were not surveyed, due to the difficulty of covering all of the terrain. Given the possible presence of malleefowl in the area, and recent reports from Traditional Owners (APYLMU, pers. comm.), their vulnerable listing and significance to the Ananngu Pitjantjatjara Yankunytjatjara, further surveys could confirm the presence of this species in the exploration areas.

Mulgara (*Dasycercus cristicauda*)

The mulgara is listed as vulnerable nationally and endangered in South Australia. They are known to inhabit sandy regions of arid central Australia and Western Australia. They inhabit hummock grass plains, sand ridges and mulga shrubland (Menkhorst and Knight 2004). Although suitable habitat does exist within the region of the PEL(A)s, Mulgaras were not captured or seen during the ten year biological survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands, and have not been seen by Ananngu on the Ananngu Pitjantjatjara Yankunytjatjara Lands for many years (Robertson *et al.* 2003). As a result it is highly unlikely that they will be encountered during the geophysical survey program, however a targeted survey program is recommended as the region has been sparsely surveyed.

Ampurta (*Dasycercus hillieri*)

Ampurta are nationally listed as endangered. Sightings of these species are extremely rare, with only few sightings in the Ananngu Pitjantjatjara Yankunytjatjara Lands in 1990. This species was found in mature hummock grasslands (spinifex) and cane grass on sand dunes in the Ananngu Pitjantjatjara Yankunytjatjara Lands. Such habitats are prevalent in PELAs 148 and 147.

Major threats are unknown, but are probably related to habitat destruction by introduced herbivores such as sheep, cattle, camels and rabbits, predation by feral cats and foxes, and changing fire regimes.

Given the extreme rarity and temporary nature of the impacts of seismic survey, this species it is unlikely to be affected by the geophysical survey program, however a targeted survey program is recommended as the region has been sparsely surveyed.

Southern marsupial mole, Yitjarritjarri, Itjaritjari (Noto*ryctes typhlops*)

The southern marsupial mole is nationally endangered and vulnerable in South Australia. The southern marsupial mole is widely distributed throughout the arid areas of central Australia, mainly in the central deserts of the Northern Territory, Western Australia and South Australia (Burbidge et al. 1988). It has a broad potential range and occurs on an assortment of land tenure such as Aboriginal land, pastoral leases, and State and Federal National Parks and reserves (Benshemesh 2004). The southern marsupial mole's distribution is known from scattered records over the sandy deserts of inland Australia including the Great Victorian Desert in the PEL(A)s.

Very little is known about the habitat preferences of the southern marsupial mole. It is most often recorded in sandy dunes with various *Acacia* and other shrubs (Corbett 1975; Johnson & Walton 1989). Such habitat is widespread and typical of the sandy deserts. While there are no clear indications of the vegetation types required by marsupial moles, underground signs of the northern marsupial mole tend to be most common on well-vegetated dunes. Deep loose sand appears to be a requirement for the southern marsupial mole. Mole tunnels are found in loose sand and are absent from firm sand.

Railways, pipeline trenches and large roads have the potential to hinder dispersal of the species and might genetically isolate populations (Benshemesh 2004). The Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands recorded the southern marsupial mole in the PEL(A)s. However, records are somewhat rare owing to the difficulty in trapping or survey this species. Although it is likely that the southern marsupial mole will occur in the PEL(A)s, the

temporary nature of the surveys will reduce the impact on this species. Where compaction of soil due to vehicular traffic is apparent, consideration for the ripping of soil will be considered in consultation with DEH as to restore the characteristics of these habitats for marsupial moles.

Warru, black-footed rock-wallaby (MacDonnell Ranges race) (*Petrogale lateralis*)

The black-footed rock-wallaby (or Warru) is nationally vulnerable and considered the most endangered mammal in South Australia. It is currently only known from three small colonies in the Ananngu Pitjantjatjara Yankunytjatjara Lands where numbers are so low that extinction is considered imminent. Predation by foxes (and dingoes) is considered the greatest immediate threat to this species.

Black-footed rock-wallabies occur in rocky outcrops and associated steep rocky slopes. They feed on grass, but some herbs and some leaves and fruits are also eaten (Eldridge and Close 1995).

The proposed geophysical surveys are unlikely to occur in or near to any rocky outcrop and associated slope habitat, as these habitats occur outside of the primary exploration target zones. Therefore the proposed geophysical survey program is unlikely to impact on black-flanked rock-wallaby.

Plains rat (*Pseudomys australis*)

The plains rat is listed as vulnerable both nationally and at the State level. The species inhabits cracking clay areas associated with minor drainage features and depressions within gibber plains (Brandle *et al*. 1999). Although once widespread, it is now mainly restricted to the Stony Plains Bioregion and some areas in the southern Northern Territory (Neagle, 2003). This species is mainly found in cracking clay and gibber with gilgai low shrubland.

A population of plains rats within the PEL(A)s is unlikely as appropriate habitats are not present. The Biological Survey of the Ananngu Pitjantjatjara Yankunytjatjara Lands did not identify this species within the PEL(A)s. Hence the species is unlikely to be affected by the proposed geophysical survey program.

Great desert skink, Tjakura, Warrarna, Mulyamiji (*Egernia kintorei*)

The great desert skink is nationally listed as vulnerable and as endangered in South Australia. Great desert skinks occupy a variety of habitat types within the western deserts region in South Australia, Northern Territory and Western Australia, which include the Great Victoria Desert in the PEL(A)s. Great desert skinks generally occur on hummock grass sand plains and some adjacent dune field swales. The recently discovered population in Ananngu Pitjantjatjara Yankunytjatjara Lands was located in an area of spinifex and Woollybutt grass (*Eragrostis* spp.) with scattered mulga. Sandplain vegetated by spinifex and scattered shrubs appear to be the habitat type most widely used by this species.

Great desert skinks are very important animals for a number of Aboriginal groups in Central Australia. The lizards are known as Tjakura by Ananngu in Central Australia and are culturally important animal under Tjukurpa (Law). They are also an important food source in traditional times; there are a number of dreaming sites dedicated to the Tjakura across the Western Desert region.

Not enough is known to confidently estimate the current population size of Tjakura because the majority of known locations occur on remote Aboriginal lands. However some important data on distribution and abundance has been gathered over recent years by Aboriginal communities around Central Australia.

Great desert skinks are known to inhabit in dune habitat in the PEL(A)s where spinifex and Woollybutt grass with scattered mulga occur (McAlpin, 2001). Where practicable habitats could be identified during clearance surveys prior to geophysical survey operations. These clearance surveys will assist in identifying great desert skink habitat so that such habitats can be avoided where possible during line clearing and geophysical surveys.

Bronzeback legless lizard (*Ophidiocephalus taeniatus)*

The bronzeback legless lizard is nationally listed as vulnerable. The bronzeback legless lizard is thought to be endemic to the west and northwest regions of the Stony Plains Bioregion (Neagle, 2003). This uncommon species is thought to be distributed along a band of stony tableland with mulga (*Acacia aneura*), from the Breakaways near Coober Pedy to the Arckaringa Hills (Brandle 1998). The preferred habitat of this species is undisturbed deep leaf litter found under trees and shrubs in loose sandy loam (Ehmann, 1981; Cogger, 2000). It has also been recorded along temporary watercourses associated with *Acacia cambagei* and *Atriplex nummularia* (Ehmann and Tynan. 1997). Brandle (1998) has suggests that mulga woodland and stony tableland drainage lines are critical habitat for the species.

Although this species has not been surveyed in the Anangu Pitjantjatjara Yankunytjatjara Lands, the secretive nature of the bronzeback legless lizard suggests that the presence of the species in the study area cannot be discounted, especially along stony drainage areas with Mulga woodlands. The Biological Survey of the Anangu Pitjantjatjara Yankunytjatjara Lands did not identify this species within the project area. To ensure that this species is not impacted during the proposed geophysical survey program, disturbance to stony drainage areas with Mulga woodlands and high leaf litter should be minimised.

4.6.2 Significant Flora Species

This section details the EPBC-listed flora species that have been recorded or may be encountered during geophysical operations in the PEL(A)s and a description of the likelihood of geophysical operations presenting a significant impact to these species.

Club spear-grass (*Austrostipa nullanulla*)

Club spear-grass is listed as vulnerable both nationally and in South Australia. In South Australia the species occurs within the Alinytjara Wilurara Natural Resource Management Region which includes the Anangu Pitjantjatjara Yankunytjatjara Lands. The species occurs on salt lake edges, crests, slopes and spurs and is in common gypsum derived soils (DEWHA 2008a).

No known populations exist within the region of the PEL(A)s and Robinson *et al*. (2003) did not find the species when they conducted a flora survey of the Anangu Pitjantjatjara Yankunytjatjara Lands. Hence the species is unlikely to be affected by the proposed geophysical survey program.

Basedowia tenrrima

Basedowia tenrrima (a daisy) is listed as nationally vulnerable and rare in South Australia. The species typically occurs among rocks and granite outcrops and is only found within the Everard and Musgrave Ranges, both located within the Ananngu Pitjantjatjara Yankunytjatjara Lands (DEHWA 2008b).

As the location of both known populations is outside of the proposed geophysical survey area, the proposed geophysical survey program is unlikely to have an impact on populations of *Basedowia tenrrima*.

Mount Illbilie mintbush *(Prosthanthera nudula)*

Mount Illbilie mintbush is listed as vulnerable both nationally and in South Australia. The species is associated with granite outcrops, often near watercourses and occurs primarily in the Everard Ranges and Sentinel Hill, both located within the Ananngu Pitjantjatjara Yankunytjatjara Lands in northern South Australia (DEHWA 2008c).

The location of the known plant populations is outside of the proposed geophysical survey area and any unknown populations are likely to exist in rocky outcrops that are not considered for exploration. Therefore the proposed geophysical survey program is unlikely to have an impact on populations of Mt Illbilie mintbush.

4.6.3 Migratory Species

There are five species covered by the migratory provisions of the EPBC Act that may occur within the proposed exploration area (Table 4.2). Four of the migratory species are widely distributed and/or oceanic species and would most likely occur as vagrant transients through the PEL(A)s rather than habituate. The habitats in the proposed exploration area are not considered to be critical habitats to the survival of any migratory species. The proposed geophysical survey program is therefore unlikely to impact these migratory species.

The fifth of the migratory species, the malleefowl, is discussed in Section 4.6.1 Threatened Fauna.

4.6.4 Introduced Species

Introduced Fauna

Eleven introduced fauna species can be found within the Ananngu Pitjantjatjara Yankunytjatjara Lands and most can be found within the region of the PEL(A)s. Table 4.3 identifies the introduced fauna species present, preferred habitat and severity of infestation.

Table 4.5 Introduced fauna species recorded on the Ananngu Pitjantjatjara Yankunytjatjara Lands

Common Name	Scientific Name	Preferred habitat and severity of infestation*
Red fox	*Vulpes vulpes*	Found most commonly in the range country living amongst the rocks. Foxes are widespread in the Ananngu Pitjantjatjara Yankunytjatjara Lands, abundance relates inversely to Dingo abundance.
Feral cat	*Felis catus*	Widespread. Particularly around the outwash areas around the Ranges and outlying hills.
Feral dog	*Canis familiaris*	Widespread, but usually occur close to or within communities on the Ananngu Pitjantjatjara Yankunytjatjara Lands.
Feral horse	*Equus caballus*	Widespread, but localised around the main ranges (Everard and Musgrave), large hills and current pastoral areas where water can be obtained.
Feral donkey	*Equus asinus*	Localised around the main ranges, large hills and current pastoral runs in the east, especially where water can be obtained in dry times.
Feral camel	*Camelus dromedarius*	Very numerous across Ananngu Pitjantjatjara Yankunytjatjara Lands. Widespread and considered to be increasing in abundance.
European cattle	*Bos taurus*	Localised where stock water supplies exist.
Feral goat	*Capra hircus*	Localised and in low numbers.
Sheep	*Ovis aries*	No longer present except for occasional flock bought in for butchering.
House mouse	*Mus musculus*	Found in all habitat types. Rare in dry seasons but irruptive following good rainfalls.
Rabbit	*Oryctolagus cuniculus*	Very numerous across the Ananngu Pitjantjatjara Yankunytjatjara Lands. An important food source for the Ananngu.

* Information gained from Robertson *et al.* (2003)

Introduced Flora

Twenty-five introduced plant species are known to exist within the Ananngu Pitjantjatjara Yankunytjatjara Lands and most can be found within the region of the PEL(A)s. Table 4.4 lists the plant species present, preferred habitat and severity of infestation.

Table 4.6 Introduced flora species existing on the Ananngu Pitjantjatjara Yankunytjatjara Lands

Common Name	Scientific Name	Preferred habitat and severity of infestation
Rosy Dock	*Acetosa vesicaria*	Plains and alluvial outwash on the north and south of the Musgrave Ranges. Most prevalent weed species in the Ananngu Pitjantjatjara Yankunytjatjara region.
Sahara mustard	*Brassica tournefortii*	Found throughout the Ananngu Pitjantjatjara Yankunytjatjara Lands
Ward's weed	*Carrichtera annua*	Dry, open and disturbed sites.
Buffel Grass	*Cenchrus ciliaris*	Observed to be well established in creeks beds at Ernabella and Indulakana. Highly invasive and is likely to have great impact on the region if unchecked.
Spiny Burr-grass	*Cenchrus echinatus*	Observed mainly around settled areas such as Mintabie and Mimili. Limited to localised infestations but has potential to spread readily.
Spiked centaury	*Centaurium spicatum*	Minimal infestation. Identified at Indulkana Spring.
Bitter apple	*Citrullus colocynthis*	Well established along roads and disturbed areas though out the Ananngu Pitjantjatjara Yankunytjatjara Lands.
Gooseberry gourd	*Cucumis myriocarpus*	Scattered locations south of the Musgrave Ranges and in Everard Ranges
Couch grass	*Cynodon dactylon*	Not known
No common name	*Cyperus hamulosus*	Ridge in the north-western Musgrave Ranges near Womikata.
Salvation Jane	*Echium plantagineum*	Found on the roadside or at roadside dumps. Limited infestation, only recorded south of Sentinel Hill.
Mediterranean lovegrass	*Eragrostis barrelieri*	Found throughout the Ananngu Pitjantjatjara Yankunytjatjara Lands
No common name	*Erodium aureum*	Found throughout the Ananngu Pitjantjatjara Yankunytjatjara Lands
Gypsophila	*Gypsophila tubulosa*	No information available
Prickly lettuce	*Lactuca serriola*	Sparsely established weed occurring at disturbed sites near settlements and on roadsides.
Small flowered mallow	*Malva parviflora*	No information available
Red natal grass	*Melinis repens* ssp. *Repens*	Mainly found along roads and railway lines. Minimal infestation found.
Castor oil plant	*Ricinus communis*	Found beside the Pipalyatjara rubbish tip.
Common Mediterranean grass	*Schismus barbatus*	Widespread, found south of Fregon and on Granite Downs.
Smooth mustard	*Sisymbrium erysimoides*	No information available
Indian hedge mustard	*Sisymbrium orientale*	
Black nightshade	*Solanum nigrum*	Scattered localities south of Musgrave

Common Name	Scientific Name	Preferred habitat and severity of infestation
		Ranges.
Common sow thistle	*Sonchus oleraceus*	Second most common weed species.
Athel pine^	*Tamarix aphylla*	Mainly found along creek beds and waterways.
Caltrop	*Tribulus terrestris*	No information available

^ Weed of National Significance.

* Information gained from Robertson *et al.* (2003)

4.7 Water Resources

4.7.1 Surface Water

The Officer Basin occurs in a low rainfall and high evaporation area. Surface water, of ephemeral or permanent nature, is virtually non-existent in the region. The ephemeral Officer Creek, the most persistent of regional surface water features, extends only approximately 50 km into the basin from the north before being absorbed, ending in PELA 148 (Alexander and Dodds, 1997). Flow along this creek is infrequent and occurs only after prolonged and heavy rainfall. Salt lakes around the southern edge of the basin are the only other evidence of surface water of any kind. These highly saline features are considered as discharge zones and may be termed playa lakes. The presence of playa lakes is limited in the Anangu Pitjantjatjara Yankunytjatjara region. There are scattered, small, clay pans southeast of the Mann Ranges within the Great Victoria Desert. These occur at the termination of the Officer Creek in PELA 148 (Robinson *et al.* 2003).

4.7.2 Aquifers

Very little groundwater information exists for the Officer Basin. Therefore, only a simple understanding of the groundwater system exists. Groundwater is considered as being interlinked in one unconfined system. The sediments are highly variable in composition and cannot be divided into aquifers and aquitards based on existing information (Alexander and Dodds, 1997).

4.7.3 Recharge and Discharge

Aside from surface flow, it is expected that most recharge into the groundwater system of the Officer Basin comes from local recharge. However the low rainfall and high evapotranspiration rates of the region suggest that little recharge would occur. Calculations described by Alexander and Dodds (1997) concluded that local recharge would be a rare event, occurring on average every 4 to 15 years.

The solitary evidence of surface discharge from aquifers within the Officer Basin is the salt or playa lakes along the southern margin of the region. The potentiometric surface confirms a general southward gradient. It is thought that nearly all discharge from the Officer Basin sediments is through the salt lakes near the Ooldea Range.

4.7.4 Water quality

There is limited data detailing water quality in the Officer Basin. In general results have shown that water quality in the Officer Basin in generally saline, with some groundwater records in the

Musgrave Block exceeding World Health Organisation limits for chlorine and nitrate (Alexander and Dodds, 1997).

4.8 Land Use

The PEL(A) areas are owned by the Ananngu Pitjantjatjara Yankunytjatjara Aboriginal group and are occupied by its community members, the largest occurring within PEL 138 at Mintabie. It is noted that geophysical exploration activities in PEL 138 will be excluded from the active Mintabie opal fields and this area is therefore not covered by the accompanying SEO.

Negotiations for Land Title of the Ananngu Pitjantjatjara Yankunytjatjara Lands commenced in the late 1970s and were finalised in November 1981 under the *Ananngu Pitjantjatjara Yankunytjatjara Land Act 1981* when the title was handed over to the people at Itjinpiri. The Ananngu Pitjantjatjara body was formed to administer the land title. Initially run out of Alice Springs the office was eventually moved onto the Ananngu Pitjantjatjara Yankunytjatjara Lands and is now based at Umuwa (Last, 2002).

A current mineral exploration licence exists within PELA 148 and several mineral licence applications are pending for PEL 138 and PELAs 147and 148. Precious stone exploration licenses exist in PELA 148 and PEL 138, where a precious stones (opal) field exists at Mintabie which has been extensively mined since 1976. A number of precious stone exploration license applications are also pending (PIRSA, 2008).

Vast areas of PEL 138 have had an ongoing history of cattle grazing. Presently no commercial numbers of cattle are farmed in the Ananngu Pitjantjatjara Yankunytjatjara Lands in PEL 138 and approximately only 90 wild cattle still occupy land south of Mintabie.

At Fregon in the 1990s, the Bureau of Resource Science funded a project to assist the community to build yards and holding paddocks for camels. A game meat processing facility is being constructed at Double Tank, near Kaltjiti, and should be operational by mid-2009. This will help to reduce the overall impact of camels on the Ananngu Pitjantjatjara Yankunytjatjara Lands.

4.8.1 Walalkara Indigenous Protected Area

Walalkara Indigenous Protected Area (IPA) exists within the boundaries of PELAs 147 and 148. It (and another IPA on the Ananngu Pitjantjatjara Yankunytjatjara Lands - Watarru) was declared in June 2000.

As well as being instilled with the stories of ancestors, the landscape is the result of thousands of years of management through traditional practices, like patch burning (DEWHA, 2008a). The environment on Walakara IPA remains largely intact, with no history of grazing and few other disturbances. Walalkara has a large diversity of reptiles and monitoring of two threatened species, the malleefowl and the southern marsupial mole is ongoing through IPA and other land management programs.

IPA funding supports traditional fire management activities and helps to maintain precious sources of water like rockholes and soakages, and feral animal control.

The two IPAs are managed in line with the following World Conservation Union category: Category VI - Managed Resource Protected Area: Protected Area managed mainly for the sustainable use of natural ecosystems (Partridge *pers comms.* APYLMU, 2009).

Limitations on mining in an IPA managed under IUCN category VI- Managed Resource Protected Area (Walalkara and Watarru) – generally requires that 75% of the overall area must remain unmodified; any activities that modify an area should not have an overall negative impact on biodiversity and cultural values of the IPA (Partridge *pers comms.* APYLMU, 2009).

4.8.2 Woomera Prohibited Area

The southern section of PEL 138 and the south-eastern section of PELA 148 are situated within the Woomera Prohibited Area (WPA). The WPA is declared under Defence Force Regulation 35 as a prohibited area for the purposes of 'the testing of war material'. The Australian Department of Defence will need to be consulted to gain a 'Deed of Access' and permission to enter the area before conducting geophysical activities.

4.8.2 Conservation Parks

There are no proclaimed parks or reserves occur within the proposed seismic survey area, although the Mamungari and Tallaringa conservation parks occur to the south of PELA 147 and PEL 138 respectively (Figure 2.1). No seismic exploration will occur within these conservation parks.

The Mamungari Conservation Park lies on the southern boarder of PELA 147 in the Great Victoria Desert. The park is run jointly between the Maralinga Tjarutja, the Pila Nguru Traditional Owners and the Department of Environment and Heritage (DEH). The park is an UNESCO World Biosphere Reserve containing arid zone wilderness and possessing cultural significance (DEH, 2008a).

The Tallaringa Conservation Park lies on the southern boarder of PEL 138 on the fringe of the Great Victoria Desert. The park consists of a vast wilderness of vegetated dunes and gibber rises (DEH, 2008b). The park supports a variety of important wildlife species that have adapted to live in the dry arid environment.

5. DESCRIPTION OF GEOPHYSICAL OPERATIONS

This EIR applies to geophysical operations in the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin, namely PEL 138, PELA 147 and PELA 148. The activities associated with the geophysical operations in this region will include the following:

- Line and access track preparation (occurs following the completion of Aboriginal and cultural heritage clearances of the lines).
- Line surveying (occurs following line preparation).
- Recording (may include seismic, gravimetric, ground magnetic, electromagnetic and others).
- Campsites and associated supplies.
- Uphole drilling and logging (during or after recording phase, as and when required).
- Monitoring and auditing of selected locations (pre and post line preparation and post restoration).
- Line access track and camp site restoration where required (following the completion of recording and uphole drilling and logging).
- Auditing and monitoring to ensure compliance with the SEO.

5.1 Description of Seismic Operations

The following description of seismic operations has been sourced from the Environmental Impact Report: geophysical operations (Santos 2006).

5.1.1 Seismic Method

The acquirement of seismic data allows an explorer to 'image' below the earth's surface to identify areas where oil and gas may have accumulated. The method by which seismic data is collected involves the transmission of an energy source into the earth's surface using a vibrator truck or buried explosives. The energy source creates sound waves, which travel through the earth's layers and are reflected back from subsurface geological structures (Figure 5.1). The returning sound waves are recorded in a digital format by a series of recording devises called geophones. The reflected and recorded data is then sent from the geophones to a seismic data processing centre which models the subsurface layers of the earth's crust. The following provides a description of the field procedures required for the acquirement of seismic data. There are two main types of seismic data acquisition, these include:

- A 2-dimentional survey (2D) records data along a single line, providing a cross-sectional 'image' of the subsurface. 2D seismic lines are normally 10 to 50 km long and spaced 500 m to 5000 m apart.
- A 3-dimentional (3D) survey records data over a 'grid' of lines simultaneously, providing a three-dimensional image of the subsurface geology, 3D seismic surveys generally cover an area of approximately 15 km to 1500 km^2.

Typically seismic lines are 4.5 m wide to allow the required vehicles access. The seismic lines are carefully laid out (either by four-wheel drive or by foot in more sensitive areas) to avoid sensitive environmental sites, cultural features, physical features (such as buildings, dams, water wells) and known Aboriginal archeological and heritage sites.

Ahava Energy plans only to conduct 2D seismic surveys during the initial phase of its seismic program on the Ananngu Pitjantjatjara Yankunytjatjara Lands ; however 3D seismic surveying and uphole drilling may be employed in future exploration activities on the Ananngu Pitjantjatjara Yankunytjatjara Lands.

5.1.2 Planning

Following the development of a proposed seismic survey program, the proposed survey lines are plotted onto topographic or satellite images as to preliminarily identify any constraints such as occupational health constraints and other physical (cliffs, escarpments and settlements), environmental and known cultural features that may inhibit the ability of the seismic crew and their equipment to move through the landscape.

One of the most important aspects of the planning phase of a seismic program is to ensure that all personnel, vehicles and acquisition equipment can sufficiently move through the landscape as to acquire sufficient data to image the subsurface geological layers.

The safety of field personnel is a key consideration of any field seismic operation and under the *Petroleum Act 2000*. This involves compromise between what is logistically, environmentally and economically possible.

5.1.3 Permitting Under the Ananngu Pitjantjatjara Yankunytjatjara Lands Act

The *Ananngu Pitjantjatjara Yankunytjatjara Lands Act 1981* gives Ananngu the power to grant permission to enter the Ananngu Pitjantjatjara Yankunytjatjara Lands unconditionally or subject to certain conditions and also the power to refuse entry. Therefore, prior to any entry of staff or contractors onto the Ananngu Pitjantjatjara Yankunytjatjara Lands permits must be granted and obtained.

The Ananngu Pitjantjatjara Yankunytjatjara *Lands Act 1981* sets out the conditions under which a person may enter the Ananngu Pitjantjatjara Yankunytjatjara Lands. In general, it is an offence for non-Ananngu persons to enter the Ananngu Pitjantjatjara Yankunytjatjara Lands without a permit. Applications for a permit to enter the Ananngu Pitjantjatjara Yankunytjatjara Lands are made in writing and lodged with the Ananngu Pitjantjatjara Yankunytjatjara administrative centre at Umuwa. Permit applications to enter the Ananngu Pitjantjatjara Yankunytjatjara Lands must indicate:

- Purpose of entry to the Ananngu Pitjantjatjara Yankunytjatjara Lands.
- Timing and location of entry to the Ananngu Pitjantjatjara Yankunytjatjara Lands.
- Length of time that the applicant wishes to stay on the Ananngu Pitjantjatjara Yankunytjatjara Lands.

5.1.4 Cultural Heritage Clearance

The following procedure details the requirements for cultural heritage clearances on the Ananngu Pitjantjatjara Yankunytjatjara Lands as defined by the Conjunctive Land Access Agreement 2009 between Ananngu Pitjantjatjara Yankunytjatjara and Ahava Energy.

Cultural heritage clearances are considered to be part of the planning process for seismic surveys and are not covered by the *Petroleum Act 2000*. Cultural heritage clearances are generally the first field activity to occur prior to a seismic survey. Clearance surveys are conducted to ensure that sites of heritage significance are identified and their avoidance is built into the determination of seismic line locations.

Cultural heritage clearances begin through early discussions between the explorer and the Traditional Owners. Anthropologists (and sometimes archaeologists) are employed to identify and protect Aboriginal heritage sites and will work closely with Ananngu monitors nominated by the Ananngu Pitjantjatjara Yankunytjatjara. The anthropologist will be the link between the field clearance operation and the Ananngu Pitjantjatjara Yankunytjatjara and will be responsible for field logistics.

The clearance teams on the Ananngu Pitjantjatjara Yankunytjatjara Lands on 2D surveys traverse the planned seismic line positions using GPS which are preprogrammed with the key line coordinates. Any cultural heritage sites encountered during the clearance survey are flagged off and a detour route is located around the site. GPS coordinates are then recorded and provided to the operator so to ensure the sites are avoided.

On 3D projects, there is more of an aerial clearance concept where all routes including selection of samples of the programmed source or receiver line positions, existing tracks, old seismic lines or creek courses can be used to investigate the 3D project area. There is more of a selective approach with high risk areas selected for detailed investigation while those considered to be of low risk are given less scrutiny. As for 2D surveys, any identified sites are flagged off and a detour route is located around the site. GPS coordinates are then recorded and provided to the operator to ensure the sites are avoided.

The personnel and vehicle requirements vary from project to project. However, light four wheel drive vehicles are generally used. Generally disturbance by four wheel drive is kept to a minimum with vehicles only passing over a given section of ground once, although in the vicinity of identified sites and detours, some backtracking can occur. Existing tracks or old seismic lines are used where possible to gain access into the program areas.

If required clearance crews and associated personnel generally camp in small camps (often with swags) in order to maximise working hours, or personnel may camp at existing nearby facilities. Survey teams consist of two specialists and up to a maximum of eight Traditional Owners in three vehicles.

5.1.5 Environmental Clearances

Environmental clearance surveys may be conducted where it is considered that geophysical operations may have a significant impact (direct or indirect) on species or habitat that supports species scheduled under Commonwealth and/or state legislation. In particular any environmental clearance surveys should prioritise the following activities:

- Identification of malleefowl habitats and mounds.
- Identification of great desert skink habitat.
- Determine baseline predator numbers.
- Determine the locations of noxious weeds that have the potential to be transferred as a result of the proposed action.

These actions should be given priority in the planning phases of geophysical operations as to minimise impacts to scheduled species and to minimise the introduction of feral species (both flora and fauna).

Environmental clearance surveys to determine the presence of malleefowl and great desert skinks has been highlighted as a priority on the Anangu Pitjantjatjara Yankunytjatjara Lands, as these species are threatened under nationally and state legislation and are culturally significant species to Anangu. Therefore environmental clearances may be conducted where possible in conjunction with cultural heritage clearance surveys as to minimise the requirement for personnel and resources. Environmental clearance surveys should utilise appropriately trained trackers (Anangu where possible) to identify the locations and habitats of malleefowl and great desert skinks so that these locations can be flagged and avoided by seismic lines. All sightings of scheduled species and their habitat should be marked using gps, a description of the finding documented and photographs taken. All information generated during these environmental clearance surveys should be provided to DEH SA and APYLMU.

Evidence from around Australia has shown that the construction of new tracks through native vegetation has enhanced access to non-native predators resulting in predation of small mammals and birds (including listed species). Management of non-native predator species has therefore been highlighted as a priority on the Anangu Pitjantjatjara Yankunytjatjara Lands. Environmental clearance surveys should, where possible, determine baseline numbers of feral predators prior to geophysical surveys. Follow-up surveys should occur periodically following seisimic line closure and restoration to determine whether numbers of predators have increased in the area as a result of geophysical operations. Understanding the numbers and types of non-native predators in the area would then assist in determining the predator management measures required and the level of effort required to manage any increase in predator numbers.

Noxious weed are apparent along many of the major roads in the Anangu Pitjantjatjara Yankunytjatjara Lands. The spread of weeds has been highlighted as a risk to the environment as a result of vehicle, machinery and human traffic that may result from the proposed geophysical operations in the Anangu Pitjantjatjara Yankunytjatjara Lands. To minimise the spread of weeds along seismic tracks it is recommended, where appropriate, that an environmental clearance survey is conducted to determine the presence of noxious weeds along the survey lines. An understanding of the location and types of noxious weeds in the geophysical survey area will inform the survey team of the level of effort required to maintain vehicle, machinery and human hygiene to prevent the spread of weeds into new areas.

5.1.6 Line and Access Track Preparation

Following cultural heritage clearances of all of the proposed seismic lines by the clearance team, the line preparation crew can commence work.

Seismic survey teams operate from a central campsite. This site may be moved every few days during 2D surveys but can remain static for up to two months on large 3D programs. Camp sites, on average, accommodate 13 personnel (including surveyors) for 2D surveys and 17 for 3D surveys. Camp units are trailer mounted for easy mobility. Campsites, where possible, are located on sites previously used, or in areas naturally devoid of vegetation. Camps are always positioned adjacent to existing tracks to minimise impacts on the terrain between the camp and tracks. Where facilities are available personnel may be accommodated at existing nearby facilities.

The line preparation crew usually operates simultaneously on different lines, characteristically using two D6 or D7 bulldozers for 2D surveys and four in 3D surveys. Other line preparation equipment may be utilised, where appropriate (e.g. loaders, rollers). Daily production of prepared line is approximately 30 km and 60 km respectively (i.e. 15 km/bulldozer), though this varies with terrain. The bulldozers will simply walk with the blade up in easily traversable terrain, with the marks of the tracks being sufficient for the surveyors to follow. The line position are pre-programmed into GPS units housed in the bulldozers with any tolerance for weaving the line around vegetation and sites of significance also programmed into the GPS. These GPS units contained in the bulldozers are kinematic dual frequency units that allow real time position fixes. These are plotted on a pilot display that also indicates the weaving tolerances for the bulldozer operators. Line preparation equipment smoothly weaves around isolated vegetation, stands of vegetation, significant landforms, undulations in terrain and through areas conducive to vehicular access. Such strategies should reduce visual impacts and minimise disturbance to vegetation and soils. Although weaving should maximise the use of natural features, sharp weaves should be minimised to reduce visual impacts (Twidale and Causa 2009). It is expected that any section of seismic line should not be visible to an on-ground observer for a length greater than 500 metres.

Blade work is kept to a minimum and generally restricted to sand dunes and floodplain crabhole habitats. Grader work is also kept to a minimum. Graders are used mainly in floodplain crabhole habitat to smooth the tracks. A method successfully used has been the ‘rill kill’ attachment (a coiled wire rope) fitted to the blades of the bulldozer to minimise the development of windrows.

All machine operators are given environmental inductions at regular intervals and receive cultural heritage training as appropriate. Bulldozer operators are required to keep a very close watch for cultural heritage sites that may not have been identified during clearance surveys. Any additional sites discovered are flagged and avoided as detailed in Section 5.1.4, Cultural Heritage Clearance.

Any sensitive environmental features such as wetlands and salt lakes are prepared without the use of heavy machinery. Light brush cutting or slashing is used in the thick vegetation zones of wetland areas to prepare 1 m to 1.5 m wide lines for foot or small vehicle access only.

A matrix of machinery use for the various landforms is shown in Table 5.1 on a scale of 0 to 5, where zero represents no application and five represents more or less constant blading or slashing.

Access tracks are prepared to the same specifications as the seismic lines.

Table 5.1 Line preparation activity by landform

Landform	Primary blading	Grader work
Drainage Lines & Floodplains	3	2
Dunes Fields	5	2
Sand Plains	3	2
Salt Lakes (Playas)	0	0
Stony Hills	0	0
Stony Plains (sparsely vegetated)	0	0
Stony Plains (densely vegetated)	1	0

5.1.7 Line surveying

Seismic surveying commences shortly after line preparation. The field surveyors use real time kinematic GPS receivers to position source and receiver points for 3D surveys and receiver points only for 2D surveys. Surveyors insert metal pins with numbered plastic tags to indicate the points. Selected points are marked by a wooden stake. Markers protrude about 0.3 m above ground level. All of these markers are removed on completion of the recording phase.

Line detours are often marked with biodegradable flagging, which is also removed. Each survey team (one surveyor in a light four-wheel drive vehicle) generally makes only one pass over any given section of line. Back-tracking possibly occurs in areas where vehicle access routes have deviated from the true line position and markers have to be inserted on foot.

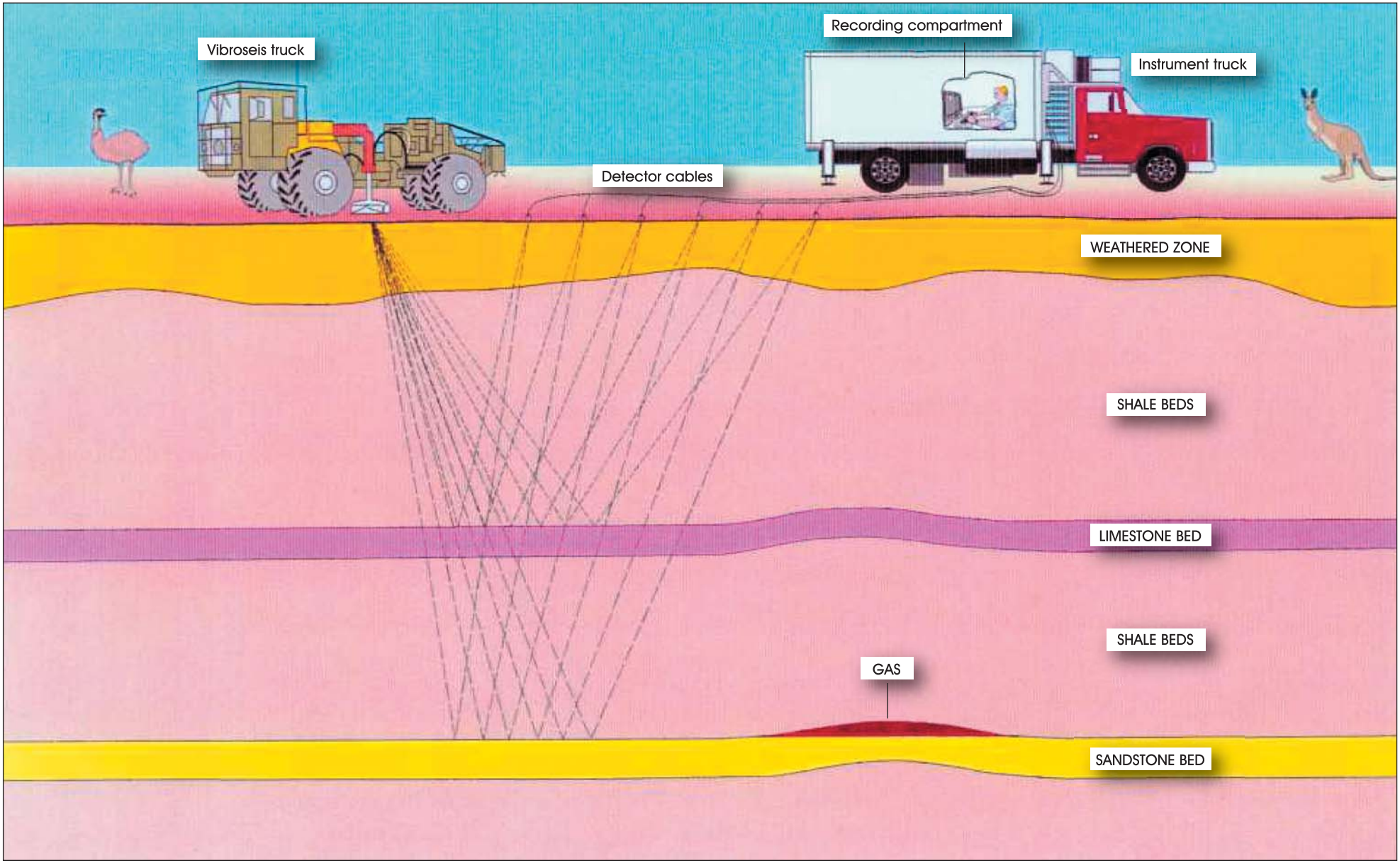
5.1.8 Recording

Recording usually commences one to three weeks after the start of line preparation depending on whether the survey is 2D or 3D. This operation is the largest part of the seismic operation in terms of personnel and vehicles. A recording crew's strength would normally be:

- For 2D operations: 34 personnel and 16 vehicles.
- For 3D operations: 42 personnel and 20 vehicles.

These figures vary with recording technique, terrain and season.

The above figures represent the average number of machinery passes on most survey lines. However, some lines are likely to be used more frequently and heavily than others as key points for entry and exit from the survey program area. These areas exposed to greater levels of vehicular traffic are often subject to greater impacts of compaction, bulldusting, rutting and banking (See 5.3 for descriptions of present operating procedures to minimize these impacts.



Source: Santos, 2006.

	coffey natural systems	Job No: 5038 File Name: 5038_01_F05.01_HB	Ahava Energy Environmental Impact Report	AHAVA ENERGY	The principle of the seismic method	Figure No: 5.1

2D Operations

Work commences with the laying of cable and deployment of geophone bundles from light four-wheel drive vehicles or in sensitive areas, on foot.

Geophone strings normally consist of 12 interconnected geophones and are dropped off at each receiver station. These strings are looped onto metal hangers for ease of handling. The geophones are then pulled off the hanger and planted in the ground by personnel on foot. Once planted, the string (typically 30 m or 37.5 m in length to match the distance between receiver points) is connected to a ‘take out’ on the recording cable.

The recording cable is spooled out from the side of the vehicle and offset to one side of the line to prevent damage from following vehicles.

Recording in 2D mode usually commences when approximately 8 km of cable and geophones have been laid. This layout is termed ‘the spread’ and a pre-selected ‘live’ section of it picks up the acoustic energy reflected from subsurface layers, converts it to electrical energy and transmits it to the instrument recording truck.

The instrument recording truck that collects, decodes and amplifies these signals, sets up at a suitable location approximately 100 m from the spread and connects to it. Once the instruments and spread have been satisfactorily tested, recording is ready to commence.

The acoustic energy source is normally an array of three or four truck-mounted vibrator units electronically synchronised to vibrate in phase with each other. They line up along a source line, a few metres apart, centered on a source point. Each unit, on command from the instrument truck, inputs one or more frequency sweeps into the ground at each source point. Each sweep lasts for only a few seconds. Generally four seconds of reflected data is recorded. The source points are typically 30 m or 37.5 m apart. On completion of one source point the set of vibrators quickly move to the next source point.

The live section of spread is approximately 4.5 km in length. This is the only part of the spread where signal is recorded for any given source position. The live spread is moved (controlled by the recording truck operator) as the vibrators move up. As spread becomes redundant behind the vibrators (back end of line) it is picked up and transported to the front end of the line. This cycle continues until the line is completed. The recording truck may move once or twice during the day to keep pace with the spread.

All operational vehicles stay on the prepared line. The exceptions being parked vehicles, spare vibrators, vibrator service truck and instrument truck, all of which have to park off line to avoid causing noisy data on the spread and interference with line traffic.

Along any single line the following vehicle passes can be expected to occur during normal operations:

- Vibrators, one pass for each truck.
- Instrument truck, one pass.
- Light vehicles 30 to 40 passes in total.
- Vibrator service truck one pass.

Source: Terrex

Plate 5.1
Typical survey line

Source: Terrex

Plate 5.2
Typical survey line

Source: Officer Basin Energy

Plate 5.3
Line surveying and recording vehicles

3D Operations

For 3D surveys, the major differences from 2D operations are that the vibrators vibrate on separate source lines to the cable/geophone lines (now termed receiver lines). Source lines are often designed to be orthogonal to the receiver lines, but other orientations may be employed. The vibrators and associated equipment use the receiver lines for access from one source line to the next, so the amount of traffic on a receiver line will be very similar to a 2D line (as above).

However, the source lines carry limited traffic i.e. the vibrators and their associated equipment plus any supervisory four wheel drive vehicle passes. Also vibrator marks will only be left on the source lines.

Typically receiver points are 40 m apart on the receiver lines and source points and 80 m apart on the source lines.

Successive receiver lines are 320 m apart as are the source lines. On occasions receiver point intervals may be as low as 35 m or as high as 50 m. This means 280 m and 400 m source and receiver line separations, respectively.

Instead of having one receiver line in 2D surveys there are now generally eight or more receiver lines recording at any time, with a further two redundant (one being picked up and moved to the front, and one at the front ready for use).

Recording in 3D mode would normally commence when about 45 km to 50 km of cable and geophones have been laid.

Despite around 70 km of spread being on the ground at any time, the receiver line impact is no more than encountered in 2D mode.

Along any single line the following vehicle passes can be expected to occur during normal operations:

- Vibrators (3 or 4 on the line plus a spare) 1 pass for each truck (source lines).
- Vibrator service truck 1 pass (source lines).
- Instrument truck 1 pass (receiver lines).
- Light vehicles 30–40 passes in total (receiver lines).

It is noted that one or more seismic lines may experience a higher traffic volume to provide access to other areas of the survey.

5.1.9 Camp Sites and Associated Supplies

There are generally only two campsites in operation: line preparation/survey camp and main camp. The former is briefly explained in the line preparation section (Section 5.1.5 Line and Access Track Preparation). The main camp houses the recording crew, crew management team and the recording and mechanical back up teams. Campsites are sited on ground conducive to camping, but never on clay pans or salt lakes. Camps are located as near as practical to existing tracks or roads to avoid the need for clearance of native vegetation and subsequent disturbance to animal habitats. Campsites are located on a previously disturbed area wherever possible.

2D projects result in frequent camp moves but with tenure lasting only a few days. The larger 3D surveys can result in the main camp being static for up to two months. This camp can often house up to 60 personnel and contain more than 20 trailers and about 36 vehicles. As the majority of these vehicles transit from camp to adjacent road and back at least once per day, and some several times, the routes from camp are clearly defined to restrict wheel track impact.

Some campsites may require multiple access routes to minimise the potential of bull dust creation. Vehicles are restricted to the perimeter of the camp and parking areas are also defined.

Putrescrible wastes (e.g., paper, cardboard and food scraps) are stored onsite along with other wastes (e.g., plastics, cans and glass) prior to disposal in a way that is aligned with EPA and requirements. Recyclable materials should also segregated on camp and transported to an appropriate licensed landfill site, or to a site approved by Anangu on the Anangu Pitjantjatjara Yankunytjatjara Lands. Storage methods ensure that litter is not exposed to scavenging fauna ensuring that no impacts of such wastes impact wildlife.

Campsites require the provision of systems for the management of sewage, which must be managed in accordance with the *Public and Environmental Health (Waste Control) Regulations 1995*. Approved septic and water environmental treatment units may be used where practical and appropriate. Following the treatment of these wastes they may be discarded onsite (away from areas connected to other water systems and away from infrastructure). The method of disposal for wastewater must comply with the *Standard for the Construction, Installation and Operation of Septic Tank Systems* in South Australia, or to be to the satisfaction of the Department of Health.

Drip trays are positioned at the refueling bowser and mechanical workshop to eliminate fuel and oil ground contamination. Any uncontained spillage or contaminated material should be collected and disposed of at an EPA licensed facility, licensed to accept the material.

If bunding or spill management is required during the geophysical activities, the EPA Guidelines 080/07 Bunding and Spill Management (June 2007) will be consulted. In addition, a staff representative should be adequately trained in the use of spill response equipment, to ensure spills are managed appropriately (including spills from equipment and vehicles).

Once the campsite has been vacated rehabilitation is undertaken, including ensuring no rubbish or any manmade items are left in-situ and, when necessary and terrain permitting, the area is tyne ripped to remove compaction and wheel tracks. Shoulders of adjacent formed tracks are reinstated. No ripping is conducted at campsites on sensitive soils (e.g., gibber plains).

5.1.10 Uphole Drilling and Logging

Uphole drilling may be carried out to provide data on surface layers for use in processing of seismic data. Where available, Ahava Energy will use previously recorded data if any exists for the region.

This component of seismic surveys consists of truck mounted uphole drilling rig(s) and logging vehicle(s), plus support water tanker trucks when mud drilling. The support camp may house six trailers or more. The rig normally drills 4.75 “diameter holes that vary in depth from project to project. Most holes are in the 30 to 90 m range. Holes are drilled using mud, air or water injection as required.

Distance between upholes can vary considerably depending on operator requirements, but are normally at 1 km to 5 km spacing along lines. This involves the lowering of a probe (down hole geophone) to the bottom of the hole and triggering a heavy weight that drops from the back of the truck to produce an acoustic impulse. The time it takes this impulse to reach the probe is recorded on a set of electronic instruments housed in the logging vehicle (usually a four-wheel drive light vehicle). This process is repeated as the probe is gradually moved up the hole. A picture is thus built up of successive travel times through the near surface layers that provide information on their thickness and velocity.

On completion of logging the drill cuttings are returned to the hole and the hole is capped. Surplus cuttings are then either spread to minimise visual impact or removed in the case of sensitive areas. In some areas, the colour of the cuttings is markedly different from the ground surface and spreading of cuttings exacerbates visual impact rather than minimise it. Removal of cuttings reduces this impact.

Source: Officer Basin Energy

Plate 5.4
Laying of geophones during a typical 2D survey

Source: Leeton McHugh (Terrex)

Plate 5.5
Uphole drilling

5.1.11 Line/access Track and Campsite Restoration

If conducted correctly, the majority of seismic lines, access tracks and camp sites do not require restoration work as one of the main objectives is to prepare and utilise them in a way that will facilitates natural recovery. However, instances that can give rise to restoration are:

- Wheel ruts caused after wet periods.
- Windrows not fully removed by grader 'rill kill'.
- Windrows removed at intersection of lines and public tracks.
- Compaction of top soil at camp sites.
- Public access tracks to be re-shouldered where necessary.
- Heavily trafficked routes between camp sites and nearest public track.
- Access tracks that have turned to bull dust due to extensive seismic traffic.
- Water course channel infill and or natural flow restriction.

Methods used for rehabilitation include:

- Ripping of compacted areas with bulldozer rear tynes.
- Windrow material pushed onto line and smoothed.
- Public road windrows reinstated.
- Wheel rut material used to infill affected areas.
- Affected water course channels and creek banks reinstated.

5.1.12 Post-survey Monitoring and Auditing

Prior to, during and subsequent to geophysical operations, assessments (some voluntary) are conducted to ensure that operations have been conducted in compliance with the SEO and any other regulatory requirements. These assessments can be implemented in a number of different ways. The following methods have been used successfully in recent years.

Prior to the commencement of any survey a number of environmental monitoring points are selected to give a balanced representation of the various landform and vegetation types encountered. The location of these points is subject to ground conditions such as flooded or restricted wetlands and salt lakes that cannot be accessed. Surveys will utilise monitoring points installed by SA DEH, the pastoral board and APYLMU if available to enable long term trends to be assessed.

These points are coordinated and marked with star droppers prior to the start of line preparation. Photographs are taken at these locations along the proposed line direction to give a view of the terrain prior to line-preparation. All photographs are optimally taken with a 50 mm lens for consistent comparison. The process is repeated after line preparation and again after recording. These environmental monitoring points are then photo monitored over the ensuing four-year period (minimum) to give a visual representation of the recovery process. The revisit intervals are generally one year, two years and four years (eight years if further visits are deemed necessary). Monitoring points and data will be provided to Anangu Pitjantjatjara Yankunytjatjara for use in its long-term habitat monitoring program.

Goal attainments scaling audits, as defined and described in the SEO, are a mandatory requirement of the SEO and are conducted after recording on representative sections of line and at the environmental monitoring point locations.

Both of these activities are normally done by one person and one four-wheel drive light vehicle.

5.2 Other Geophysical Surveying Operations

Other geophysical surveys do not have the same extent of operations as seismic surveying. Most use four-wheel drive vehicles or are done on foot and involve taking some measurement along traverses, like 2D seismic traverses, but more like activities involved in 'Line surveying' as detailed in Section 5.1.6. Measurements can be of a passive nature, such as measurement of gravity, magnetic or electromagnetic fields, or involve input of some signal into the earth, such as small electrical or electromagnetic signals.

5.3 Current Standard Operating Procedures Used to Minimise Impacts

In order to mitigate the risks and potential impacts of geophysical operations detailed in this EIR and to achieve the objectives of the SEO, the following recommended procedures are detailed.

5.3.1 Cultural Heritage

- Lines are cleared by appropriate Anangu Pitjantjatjara Yankunytjatjara representatives prior to commencement of line preparation.
- Sites of cultural significance are flagged and lines deviated around them.
- Receiver lines may be laid out only by foot through some sites and all vehicles are excluded.
- All line preparation personnel and crew supervisors receive cultural heritage training prior to work.

5.3.2 Terrain

Wheel Tracks

- Where possible, existing tracks, roads or seismic lines are used for access.
- Off line driving for the main crew is banned. No 'bush bashing' or short cuts are permitted.
- Campsites are positioned close to existing roads where possible.

Wheel Ruts

- Operations are shut down during wet weather or flooding and only restarted once potential for extensive damage has passed. Unavoidable damage is reported and reinstated on completion of work.
- Vehicles will always travel at appropriate speeds and avoid making sharp turns.
- Where possible vehicles should follow the natural contours of the terrain and avoid sharp turns.
- No vehicles are allowed on salt lakes other than specialised low-pressure wide profile tyre vehicles.
- It is not proposed to traverse or otherwise work on playa lakes.

Compaction

- Following in previous off-line wheel tracks is banned.
- Unavoidable compaction is reported is ripped on completion of work.
- Rubber tyres are preferable to metal treads.
- As few campsites as possible are used — the aim is to share existing sites if possible.
- Camp sites are ripped if necessary on completion of work.

Erosion

- Blade work is not to be done on flat easy terrain.
- Minimal blade work is permitted elsewhere e.g. sand dunes.
- All windrows are removed either during or on completion of work.
- Dune side cuts are minimised.
- Removed sand is ramped to the side of dune cuts, as opposed to the base of the dune.
- Vegetation is pulled back on the line on steeper slopes following geophysical acquisition.
- Creek bank vegetation is left intact and detours sought if too dense to pass through.
- On completion of geophysical operations tracks should be lightly graded to smooth the tracks.
- Weaving is done in a smooth manner to avoid rutting and banking of materials.

Bulldust

- Susceptible tracks are avoided. If not possible then track is reinstated after rain.

Visual Amenity

- Lines are prepared to a single blade width (only ~4 m to 5 m).
- Ground that is more conducive to vehicular access should be utilised as much as possible.
- Lines will be weaved with consideration to industry best practice to minimise disturbance to land surfaces and vegetation, and to reduce visibility along seismic lines.
- As a minimum, seismic lines shall:
    - weave smoothly to prevent the scalloping (including banking) and rutting on sharp corners.
    - weave every 500 metres or less to prevent seismic lines being visible for any unwarranted length.
- Lines are doglegged at road and track crossings, preferably around vegetation.
- Bulldozers are walked with blade up wherever possible.
- Cuts are minimised at dune crests and base of dunes.
- Dune side cuts are minimised.
- Dune cuts are offset.

- No cutting is done on dunes adjacent to public roads.
- The entry points to visible lines should be disguised using soil and vegetation barriers.

Natural Drainage

- Creek bank vegetation is left intact and detours sought if too dense to pass through.
- Creek crossings are boxed and filled to original bed level when hard fill required.
- Any windrows or other disturbance to drainage patterns are removed from creek bed crossings and swales.
- Camps should not be established near major watercourses, creeks or surface water bodies.
- No campsite shall be located within 1 km of rockholes.
- All windrows are removed either during or on completion of work.

5.3.3 Native Vegetation

- Off-line driving is banned. No bush bashing or short cuts are permitted.
- Vegetation is removed only when absolutely necessary and is minimised by weaving lines through vegetated areas where vehicular access is more conducive.
- Root stock, topsoil and seeds are left on line as much as possible during line preparation.
- Creek bank vegetation is left intact and detours located if dense.
- All vehicles are thoroughly cleaned to prevent the introduction of weeds into the survey area.

5.3.4 Native Fauna / Habitat

- Upholes are capped and backfilled to prevent injury or death to wildlife.
- Natural drainage channels are left clear at line crossings.
- Creek bank vegetation is left intact and detours located if dense.
- All vehicles are thoroughly cleaned to prevent the introduction of weeds into the survey area (See section 5.3.8).

5.3.5 Pollution

- Bunding is required to contain hazardous materials
- Fuel and oil spills are reported, chemically treated or bio-remediated and the ground ripped.
- No refueling occurs outside of designated refueling stations.
- Appropriate spill response equipment is available on site.
- Oil spill areas are ripped to an appropriate depth.
- Records of spill events and corrective actions are maintained in accordance with company procedures and are available for audit.

- Camp wastewater is disposed of by drainage channels and seepage pits (and away from playa lakes).
- It is important that wastewater is not allowed to freely permeate the soil (EPA 509/04 Guidelines).
- Wherever practical, biodegradable and non-recyclable waste should be transported to a licensed waste facility off the Ananngu Pitjantjatjara Yankunytjatjara Lands.
- All plastics, metals and other recyclable materials should be segregated and regularly transported to a licensed waste facility off the Ananngu Pitjantjatjara Yankunytjatjara Lands.
- Mobile chemical toilets are used on all camps.
- Degraded toilet waste is disposed in accordance with *Public and Environmental Health (Waste Control) Regulations 1995.*
- There is a zero tolerance rule with regard to markers and litter left in work area after completion.
- Drill cuttings are returned to hole or removed for dump disposal.
- Vehicles travel at slow speed in the vicinity of camps, dwellings and other populated areas and in areas of known threatened fauna species.

5.3.6 Landowner Infrastructure

- Lines are pre-planned to avoid homesteads, associated buildings, stockyards, airstrips, dams, bores and tanks.
- Seismic sources are activated at an appropriate distance from any infrastructure to ensure that no damage is incurred.
- Gates are left as found.
- Integrity of fences will be maintained by appropriate means.
- Water is drawn only from authorised sources.
- No camp is set up within 1 km of rockholes.
- Work is scheduled to fit in with stock locations and the mustering schedule.
- Waste management policies are enforced.

5.3.7 Third Party Access

- No line preparation is carried out on dunes adjacent to public roads.
- Lines are doglegged at road and track crossings preferably using existing vegetation as a screen.
- Windrows/shoulders on public tracks are reinstated on completion of work.
- Lines adjacent to public roads may also be blocked with timber as an access deterrent.

5.3.8 Prevention of the Spread of Weeds and Pathogens

The following details hygiene measures used to minimise the spread of weeds and pathogens and has been adapted from the DEH SA's standard operating procedure for machinery hygiene (for Buffel grass) and from operational experience.

- Where possible avoid working in areas infested by noxious weeds and pathogens.
- Where possible avoid earth moving operations and the transport of topsoil into new areas.
- After working in areas infested with weeds or moving between new areas machinery will be inspected for weeds and a determination will be made as to the level of cleaning required, depending on where the vehicles have previously been and the potential for those vehicles to be vectoring weeds or pathogens.
- Where machinery is required to be cleaned, all machinery and personnel will be isolated at a designated clean-down site. Clean-down will ensure that attention is given to cleaning the radiator, tyres and mud guards, all ledges and frames where dust, seeds or mud can collect, the front and back of any blades, removal of seeds attached to clothes, skin and hair and from the bottoms of shoes.
- Cleaning should preferentially be done using a mobile pressure cleaner or fire fighters unit (for clean-down in wet conditions), an air compressor with hose (for clean-down in dry conditions), a dustpan and broom (for cleaning inside cabins) and a hand broom or wire brush for cleaning tyres and mud guards.

6. ENVIRONMENTAL HAZARDS AND CONSEQUENCES

Onshore geophysical exploration surveys have the potential to leave a footprint on the environment. However, awareness of the potential hazards and consequences allows the risks to be appropriately mitigated, managed and monitored.

This section provides a description of potential environmental hazards associated with geophysical exploration surveys and describes the possible consequences resulting from conducting these activities in the Anangu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin.

Evaluation of the environmental risks associated with routine operations and unplanned events and their environmental management and mitigation measures are discussed further in Section 7 Risk and Management Strategies.

For the purposes of this EIR, definitions of hazard and consequence are taken from the joint Australian/New Zealand Standard (AS/NZS) 4360: 2004 Risk management. A hazard is defined as a source of potential harm or a situation with the potential to cause loss. A consequence is defined as an outcome or impact of an event.

6.1 Activities with Potential to Result in Hazards

Activities associated with geophysical exploration that have the potential to lead to environmental hazards are identified as:

- Earthworks associated with construction and reparation of line and access tracks.
- Traversing of vehicles.
- Seismic source activation.
- Spills or leaks occurring during storage of oil, fuels and chemicals, refueling activities and high pressure hydraulic systems.
- Generation of domestic and chemical waste.
- Uphole drilling.

6.2 Consequences

Significant potential environmental consequences related to the previously listed hazards include:

- Disturbance or damage to Anangu and non-Aboriginal cultural heritage sites.
- Disruption of socio-economic livelihood and/or Anangu way of life.
- Visual impacts.
- Facilitation of third party access and vehicular movement due to seismic lines and access tracks.

- Disturbance or loss of native vegetation and habitat.
- Introduction or dispersion of weeds and pathogens via equipment.
- Provision of passage to invasive fauna and predators species along cleared tracks (e.g., foxes and cats).
- Contamination of soil and water.
- Injury or death of persons.
- Disturbance, injury or death of native fauna.
- Disturbance, injury or death of livestock.
- Disturbance to land surfaces e.g. compaction, deflation and erosion.
- Soil erosion by wind and water due to earthworks, increased vehicular movement and loss of vegetative cover.
- Disturbance to natural drainage patterns.
- Decreased air quality due to dust generation.
- Destruction of habitat, property and injury to persons resulting from fire.
- Damage to infrastructure.

6.3 Hazards and Consequences by Activity

The various activities associated with each stage of seismic operations are listed in Table 6.1, with the activities leading to hazards and the potential consequences related to each activity also catalogued.

Table 6.1 Hazards and consequences related to various seismic activities

Seismic activity	Hazard Activity	Potential consequences
Line surveying	Traversing of vehicles	Visual impacts Facilitation of third party access and vehicular movement Fire Disturbance or loss of native vegetation and habitat Disturbance, injury or death of native fauna Disturbance, injury or death of livestock Dispersion of weeds and pathogens Provision of passage to invasive fauna species and predator species Injury or death or persons Disturbance to land surfaces Decreased air quality due to dust generation Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites Disruption of Ananngu way of life Damage to infrastructure
Preparation of lines and access tracks	Earthworks, traversing of vehicles, spills and leaks	Visual impacts Facilitation of third party access Disturbance or loss of vegetation, habitat and property and habitat by fire Disturbance or loss of vegetation and habitat Dispersion of weeds and pathogens Provision of passage to invasive fauna species and predator species Injury or death or persons Disturbance to native fauna Disturbance to livestock Disturbance to land surfaces Disturbance to drainage patterns Disruption of Ananngu way of life Dust generation Contamination of soil and water Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites Damage to infrastructure
Recording	Traversing of vehicles, vibrator movement, spills and leaks	Visual impacts Facilitation of third party access Disturbance or loss of vegetation, habitat and property and habitat by fire Disturbance or loss of vegetation and habitat Dispersion of weeds and pathogens Provision of passage to invasive fauna

Seismic activity	Hazard Activity	Potential consequences
		species and predator species Injury or death or persons Disturbance to native fauna Disturbance to livestock Disturbance to land surfaces Disturbance to drainage patterns Disruption of Ananngu way of life Dust generation Contamination of soil and water Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites Damage to infrastructure
Campsites and associated materials	Traversing of vehicles, spills and leaks, generation of waste, fire	Visual impact Injury or death or persons Disturbance or loss of vegetation and habitat Disturbance or loss of vegetation, habitat and property and habitat by fire Attraction of native fauna to human waste products such as food scraps Disturbance to land surfaces Contamination of soil and water Noise Disruption of Ananngu way of life Dust generation Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites Damage to infrastructure
Up-hole drilling and logging	Spills and leaks, waste generation, up-hole drilling activity	Visual impact Contamination of soil and water Uncontrolled discharge or contamination of aquifers Disturbance to land surfaces Disturbance to native fauna Disturbance to livestock Dispersion of weeds and pathogens Damage to landholder infrastructure
Rehabilitation of lines, access tracks and campsites	Earthworks, traversing of vehicles, spills and leaks	Visual impacts Facilitation of third party access Disturbance or loss of vegetation and habitat Disturbance or loss of vegetation, habitat and property and habitat by fire Dispersion of weeds and pathogens Provision of passage to invasive fauna species and predator species Injury or death or persons

Seismic activity	Hazard Activity	Potential consequences
		Disturbance to native fauna Disturbance to livestock Disturbance to land surfaces Disturbance to drainage patterns Disruption of Ananngu way of life Dust generation Contamination of soil and water Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites Damage to infrastructure
Monitoring of selected locations	Traversing of vehicles	Facilitation of third party access Dispersion of weeds and pathogens Provision of passage to invasive fauna species and predator species Injury or death or persons Disturbance to native fauna Disturbance to livestock Disturbance to land surfaces Disruption of Ananngu way of life Dust generation Contamination of soil and water Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites Damage to infrastructure

6.3.1 Line surveying

When the location of seismic lines has been confirmed, the surveyors peg out the location of each line by placing markers at intervals along the lines. The potential hazards occurring from line surveying are related to the traversing of vehicles along the line and the possibility of spills or leaks from those vehicles. The vehicle movement may disturb native fauna and livestock, spread weeds and pathogens and generate dust. Any spills or leaks from the vehicles could contaminate surrounding soil and water.

6.3.2 Preparation of Lines and Access Tracks

Preparation of lines and access tracks is likely to pose the most significant hazards of all the activities related to seismic surveys. Given the remote location of the seismic survey, within the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin, it is very likely that significant development of access tracks in areas with little or no existing roads or previous seismic activities will be required. Lines are required to be 4 m to 5 m wide to accommodate the vibroseis trucks. These clearances are necessary prior to the commencement of the seismic survey.

Preparation of lines and tracks requires some extent of vegetation clearing, causing disturbance or loss of vegetation and habitat. The preparation of lines may also provide greater access to fauna that may not otherwise be present, including predator species. Although new techniques

aim to minimise removal of topsoil, plants and rootstock there is the potential for increased erosion and dust generation, damage to soil structure and disturbance to drainage patterns. Damage may also be caused to sites of cultural significance and infrastructure.

It is possible that the equipment used for the preparation of the lines and tracks may spread weeds and pathogens and contaminate soil and water as it progresses along tracks and moves through the licence areas. The longevity of the impact of lines and tracks throughout the PEL(A)s can impact the visual amenity of the area, can facilitate third party access, and may disturb native fauna and livestock.

6.3.3 Recording

As the seismic crew moves along the line, applying the energy source approximately every 10 m to 50 m, potential environmental hazards include the movement of the vehicles, the vibrator operations and the possibility of spills and leaks from the fleet. Consequences of these hazards include damage to soil structure in the form of compaction from the heavy vehicles and the vibrator pad activity, erosion encouraged by vehicle movement, dispersion of weeds and pathogens by equipment, noise and dust generation, and contamination of surrounding soil and water. The presence of the fleet may also disturb native fauna and livestock.

6.3.4 Campsites

Temporary campsites for the seismic crew are set up on already cleared land where possible but can pose significant hazards to the local environment if incorrectly managed. Campsites generate considerable domestic and chemical waste, increase levels of traffic in the local area and risk spills and leaks from numerous sources. Consequences associated with these hazards include disturbance or loss of vegetation and habitat, damage to soil structure, noise and dust generation, litter, accidental wildfire and soil and water contamination. The presence of the temporary campsites has a visual impact and may impinge on areas of cultural significance.

6.3.5 Uphole Drilling and Logging

Uphole drilling and logging is sometimes employed along the seismic lines. Operation of a drilling rig can be a hazardous activity, spills and leaks can occur, and disposal of chemical waste is an issue. Possible environmental consequences of uphole drilling include damage to soil structure, dust and noise generation, damage to vegetation and habitat, dispersion of weeds and pathogens by the equipment, disturbance to native fauna and livestock, contamination of soil and aquifers, and the possible subsidence if holes are not backfilled correctly. Drilling could also cause damage to cultural heritage sites, infrastructure and visual amenity.

6.3.6 Rehabilitation of Lines, Tracks and Campsites

Some activities conducted while rehabilitating lines, tracks and campsites can be environmentally hazardous themselves. To rehabilitate and restore areas impacted by seismic activities it may be necessary to re-grade line spoil and place any graded vegetative cover back on to the cleared track. Earthworks and vehicle movement may be required and potential consequences of these activities include damage to soil structure, disturbance to native fauna and livestock, noise and dust generation, dispersion of weeds and pathogens, contamination of soil and water and damage to infrastructure and cultural heritage sites.

6.3.7 Monitoring

Monitoring programs may be established for some access tracks or seismic lines particularly those within areas of significance, environmentally, culturally or otherwise. Vehicles will be required to traverse the line or track, potentially resulting in damage to soil structures, dust generation, dispersion of weeds and pathogens and damage to infrastructure and cultural heritage sites.

7. RISK AND MANAGEMENT STRATEGIES

Environmental risk assessment evaluates the probability of an event causing a potentially undesirable environmental effect. It is a requirement of the Petroleum Act that the environmental risks associated with the seismic activities proposed by Ahava Energy are assessed.

A risk-based approach was used to identify environmental hazards and assess the potential impacts associated with the geophysical exploration surveys proposed by Ahava Energy in the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin. The risk assessment involved the following steps:

- Identify and assess hazards to stakeholders and the terrestrial environment during the seismic survey.
- Conduct a scenario-based risk assessment, using the risk management method based on the Australian and New Zealand Standards for Risk Assessment (AS/NZS 4360:2004).
- Identify and rank major hazards and the resulting impacts; mitigation strategies will be further developed in the SEO.

The following definitions are critical in the understanding of hazard and risk assessment.

Accident: an event capable of causing critical, major, moderate or minor damage to the environment, or negligible damage with no significant environmental effect.

Hazard: a physical situation with the potential for damage to the environment, human injury, damage to property or a combination of these.

Risk: the likelihood of a specified undesired event occurring within a specified period or in specified circumstances. It may either be a frequency (the number of specified events occurring in a time unit) or a probability (the probability of a specified event following a prior event), depending on circumstances.

7.1 Environmental Hazards and Consequences

Environmental risk assessment begins with the identification of environmental hazards and potential consequences resulting from the proposed activities. The principal hazards and consequences related to the seismic operations in the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin were identified in Section 6, Environmental Hazards and Consequences. Seismic operations have been conducted previously in the Officer Basin and surrounding areas, resulting in an existing understanding of the hazards and potential consequences and how they can best be mitigated by management measures.

7.2 Hazard Identification

The process of hazard identification and risk management are divided in three main sections (reproduced from AS/NZS 4360:2004):

- External and environmental hazards (global hazards):

  - Project-specific hazards (project implementation issues).
  - Personnel health hazards (a global hazard).
- Individual and special operations hazards during operations that are exceptional because of size, complexity or timing.
- General and routine work performed according to standard procedures.

7.3 Severity of Consequence

For the purposes of this EIR, environmental consequences are categorised from negligible to catastrophic (Table 4.1). Definitions and methodology are adapted from the AS/NZS 4360:2004 and Knight (1999).

Table 7.1 Severity of consequences

Severity	Qualitative description of environmental consequences
Negligible	Possible incidental impacts to flora and fauna in a locally affected environmental setting but without ecological consequence.
Minor	Temporary changes to the abundance or biomass of biota, and existing soil and/or water quality in the affected environmental setting without changes to biodiversity or ecological function. Land system experiences small change but no long-tem impact that will alter the terrain surface.
Moderate	Changes to the abundance or biomass of biota, and existing soil and/or water quality in the affected environmental setting, with local changes to biodiversity but no loss of ecological function. Land system surface has changes that may cause long-term impacts.
Major	Substantial changes to abundance or biomass of biota, existing soil and/or water quality in the affected environmental setting with significant change to biodiversity and ecological function. Eventual recovery of ecosystem possible, but not necessarily to the same pre-incident conditions. Changes to terrain that will alter the terrain surface and drainage patterns.
Catastrophic	Irreversible and irrecoverable changes to abundance/biomass or aquifers in the affected area. Loss of biodiversity on a regional scale. Loss of ecological functioning with limited prospect of recovery to pre-incident conditions. Widespread impact on the terrain surface and drainage patterns.

7.3.1 Assessment of Likelihood

The environmental risk assessment process requires the estimation of the likelihood of the potential environmental consequences occurring. The likelihood of the consequences occurring was qualitatively assessed and categorised from rare to almost certain using definitions (Table 6.2) and methodology adapted from the AS/NZS 4360:2004 and Knight (1999).

Table 7.2 Severity of consequences

Likelihood	Description
Almost certain	Is expected to occur in most circumstances or happens continuously
Likely	Likely to occur in most circumstances during operational lifetime
Possible	Might occur at some time
Unlikely	Could occur during operational lifetime but is unlikely and unexpected
Rare	May only occur in exceptional circumstances

7.4 Risk Matrix

Each scenario was assessed using the risk matrix approach (Table 6.3). A risk estimate was made on the basis of the probability of the event occurring and the consequence. Matrix locations were chosen on the basis of operational and environmental judgement.

Table 7.3 Qualitative risk analysis matrix – level of risk

		SEVERITY OF CONSEQUENCE				
		Negligible / Insignificant	**Minor**	**Moderate**	**Major**	**Catastrophic**
LIKELIHOOD	**Almost certain**	MEDIUM	HIGH	HIGH	VERY HIGH	VERY HIGH
	Likely	LOW	MEDIUM	HIGH	HIGH	VERY HIGH
	Possible	LOW	MEDIUM	MEDIUM	HIGH	HIGH
	Unlikely	LOW	LOW	MEDIUM	MEDIUM	HIGH
	Rare	LOW	LOW	MEDIUM	MEDIUM	HIGH

7.5 Environmental Hazard and Risk Assessment

Table 6.4 presents the environmental hazard and risk assessment for seismic operations in the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin. The risk analysis impact and likelihood (columns 4 and 5) draw from the definition of consequence in Table 6.1 and likelihood in Table 6.2. The risk evaluation draws from the matrix in Table 6.3.

The results of the risk assessment indicate that risk levels for the proposed seismic activities in the Officer Basin can be classified as ‘low’ or ‘medium’ risk, with no high or very high risks identified. This reflects the temporary and low impact nature of the activity, and the application of appropriate mitigation measures.

Table 7.4 Summary of impacts and risk levels for seismic operations

Seismic activity	Hazard	Potential consequences	Severity	Likelihood	Risk
Line surveying	Traversing of vehicles	Visual impacts	Minor	Unlikely	Low
		Facilitation of third party access and vehicular movement	Minor	Unlikely	Low
		Disturbance or loss of native vegetation and habitat	Minor	Unlikely	Low
		Disturbance, injury or death of native fauna (and promotion of weed growth through soil disturbance)	Minor	Rare	Low
		Disturbance, injury or death of livestock	Minor	Rare	Low
		Dispersion of weeds and pathogens (and promotion of weed growth through soil disturbance)	Moderate	Possible	Medium
		Provision of passage to invasive fauna species and predator species	Moderate	Unlikely	Medium
		Injury or death or persons	Major	Rare	Medium
		Disturbance to land surfaces	Minor	Unlikely	Low
		Decreased air quality due to dust generation	Minor	Unlikely	Low
		Disturbance or damage to Anangu and non-Aboriginal cultural heritage sites	Major	Rare	Medium
		Damage to any conservation park or reserve	Moderate	Rare	Medium
		Disruption of Anangu way of life	Major	Rare	Medium
		Damage to infrastructure	Minor	Unlikely	Low
Preparation of lines and access tracks	Earthworks, traversing of vehicles, spills and leaks	Visual impacts	Minor	Likely	Low
		Facilitation of third party access	Possible	Unlikely	Medium
		Disturbance or loss of vegetation and habitat	Minor	Almost Certain	High
		Dispersion of weeds and pathogens (and promotion of weed growth through soil disturbance)	Moderate	Possible	Medium
		Provision of passage to invasive fauna species and predator species	Moderate	Possible	Medium
		Injury or death or persons	Major	Unlikely	Medium
		Disturbance to native fauna	Minor	Possible	Medium
		Disturbance to livestock	Minor	Unlikely	Low
		Soil erosion	Minor	Unlikely	Low
		Damage to soil structure	Minor	Unlikely	Low
		Disturbance to drainage patterns	Minor	Unlikely	Low

Seismic activity	Hazard	Potential consequences	Severity	Likelihood	Risk
		Disruption of Ananngu way of life	Major	Unlikely	Medium
		Damage to any conservation park or reserve	Moderate	Rare	Medium
		Dust generation	Minor	Possible	Medium
		Contamination of soil and water	Minor	Unlikely	Low
		Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites	Major	Unlikely	Medium
		Damage to infrastructure	Minor	Unlikely	Low
Recording	Traversing of vehicles, vibrator movement, spills and leaks	Visual impacts	Minor	Unlikely	Low
		Facilitation of third party access	Minor	Unlikely	Low
		Disturbance or loss of vegetation and habitat	Minor	Unlikely	Low
		Dispersion of weeds and pathogens (and promotion of weed growth through soil disturbance)	Moderate	Possible	Medium
		Provision of passage to invasive fauna species and predator species	Minor	Unlikely	Low
		Injury or death or persons	Major	Rare	Medium
		Disturbance to native fauna	Minor	Unlikely	Low
		Disturbance to livestock	Minor	Unlikely	Low
		Soil erosion	Minor	Possible	Medium
		Damage to soil structure	Minor	Possible	Medium
		Disturbance to drainage patterns	Minor	Rare	Low
		Disruption of Ananngu way of life	Major	Unlikely	Medium
		Dust generation	Minor	Possible	Medium
		Damage to any conservation park or reserve	Moderate	Rare	Medium
		Contamination of soil and water	Minor	Unlikely	Low
		Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites	Major	Unlikely	Medium
		Damage to infrastructure	Minor	Unlikely	Low
Campsites and associated materials	Traversing of vehicles, spills and leaks, generation of waste, fire	Visual impact	Minor	Unlikely	Low
		Injury or death or persons	Major	Rare	Medium
		Disturbance or loss of vegetation and habitat	Minor	Possible	Low
		Disturbance or loss of vegetation and habitat by fire	Moderate	Unlikely	Low
		Attraction of feral species to human waste products such as food scraps	Moderate	Possible	Medium
		Introduction, promotion or dispersion of weeds and ferals	Moderate	Possible	Medium

Seismic activity	Hazard	Potential consequences	Severity	Likelihood	Risk
		Soil erosion	Minor	Unlikely	Low
		Contamination of soil and water	Minor	Unlikely	Low
		Damage to soil structure	Minor	Unlikely	Low
		Noise	Minor	Unlikely	Low
		Disruption of Ananngu way of life	Major	Unlikely	Low
		Dust generation	Minor	Unlikely	Low
		Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites	Major	Unlikely	Medium
		Damage to infrastructure	Minor	Unlikely	Low
Uphole drilling and logging	Spills and leaks, waste generation, uphole drilling activity	Visual impact	Minor	Unlikely	Low
		Contamination of soil and water	Minor	Unlikely	Low
		Uncontrolled discharge or contamination of aquifers	Minor	Unlikely	Low
		Damage to soil structure	Minor	Unlikely	Low
		Disturbance to native fauna	Minor	Unlikely	Low
		Disturbance to livestock	Minor	Unlikely	Low
		Dispersion of weeds and pathogens (and promotion of weed growth through soil disturbance)	Moderate	Possible	Medium
		Damage to landholder infrastructure	Minor	Unlikely	Low
Rehabilitation of lines, access tracks and campsites	Earthworks, traversing of vehicles, spills and leaks	Visual impacts	Minor	Unlikely	Low
		Facilitation of third party access	Minor	Unlikely	Low
		Disturbance or loss of vegetation and habitat	Minor	Unlikely	Low
		Dispersion of weeds and pathogens (and promotion of weed growth through soil disturbance)	Moderate	Unlikely	Medium
		Provision of passage to invasive fauna species and predator species	Minor	Possible	Medium
		Injury or death or persons	Major	Rare	Medium
		Disturbance to native fauna	Minor	Possible	Medium
		Disturbance to livestock	Minor	Unlikely	Low
		Soil erosion	Minor	Unlikely	Low
		Damage to soil structure	Minor	Unlikely	Low
		Disturbance to drainage patterns	Minor	Unlikely	Low
		Disruption of Ananngu way of life	Major	Unlikely	Medium
		Dust generation	Minor	Unlikely	Low
		Contamination of soil and water	Minor	Unlikely	Low
		Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites	Major	Unlikely	Medium

Seismic activity	Hazard	Potential consequences	Severity	Likelihood	Risk
		Damage to infrastructure	Minor	Unlikely	Low
Monitoring of selected locations	Traversing of vehicles	Provision of passage to invasive fauna species and predator species	Minor	Unlikely	Low
		Injury or death or persons	Major	Rare	Medium
		Disturbance to native fauna	Minor	Unlikely	Low
		Disturbance to livestock	Minor	Unlikely	Low
		Soil erosion	Minor	Unlikely	Low
		Damage to soil structure	Minor	Unlikely	Low
		Disruption of Ananngu way of life	Major	Unlikely	Medium
		Dust generation	Minor	Unlikely	Low
		Contamination of soil and water	Minor	Unlikely	Low
		Disturbance or damage to Ananngu and non-Aboriginal cultural heritage sites	Major	Unlikely	Medium
		Damage to infrastructure	Minor	Unlikely	Low

7.6 Management of Environmental Risks

7.6.1 Management Systems

An Environmental Management System (EMS) is a tool used to manage the impacts of activities on the environment. It provides a structured approach to planning and implementing environment protection measures. An EMS can be a powerful tool for an organisation to both improve environmental performance, and to integrate environmental management into a company's daily operations, long-term planning and other quality management systems.

There are a number of components to an EMS, including:

- Environmental policy.
- Environmental impact identification.
- Objectives and targets.
- Consultation.
- Operational and emergency procedures.
- Environmental management plan.
- Responsibilities and reporting structure.
- Review audits and monitoring compliance.
- Continual improvement.

Ahava Energy or its contractors should conduct regular audits of an EMS to ensure that environmental responsibilities, issues and risks are being updated, as new information evolves. Ahava Energy and its contractors should also ensure that any risks are managed appropriately and systems are maintained and implemented adequately.

7.6.2 Emergency Response, Contingency Planning and Training

To manage any environmental incidents and accidents, emergency response plans should be designed to improve incident preparedness and response.

Many design and operational measures are available to reduce the chance of incidents, but rarely can all risk be mitigated. Therefore a contingency plan is needed for all facilities and activities that have the potential to result in environmental impacts.

Ahava Energy or their contractors should ensure that personnel are familiar with the plans and the types of incidents to which they apply. Emergency response plans should be reviewed and updated on a regular basis to incorporate new information arising from any incidents, near misses and hazards.

Staff and contractors should complete training courses, using a combination of theory and practical training, to develop the skills and attitudes to work safely, and respond appropriately to emergencies and incidents that may arise.

7.6.3 Environmental Monitoring and Audits

Monitoring and auditing are key elements of environmental management. Environmental monitoring should be carried out to observe the occurrence and extent of any environmental impacts and any recovery over time, compliance of environmental administration and performance of an operator with sound environmental practice, and site specific environmental targets and principles. Environmental monitoring and auditing should be linked to adaptive management in response to the outcomes.

7.6.4 Environmental Incident Management, Recording and Reporting

Internal and external reporting procedures should be implemented by Ahava Energy or their contractors to ensure that environmental issues and/or incidents are appropriately responded to. Systems should be established to record and report on any incidents or near misses, progress against key performance indicators, works in progress and internal and external meetings. Such systems should provide a mechanism for recording of any ‘reportable’ incidents, as defined under the *Petroleum Act 2000*.

External reporting should be conducted in accordance with the requirements of the *Petroleum Act 2000* and the SEO.

7.6.5 Inspection and Maintenance Activities

Vehicles and other equipment used during the seismic activities should be regularly inspected and maintained appropriately in accordance with equipment specific operational requirements and industry standards.

7.6.6 Pest Plant and Animal Control

The introduction and dispersion of pest plants, animals and pathogens by the operators through vehicle and equipment movement is a potential consequence of activities related to the proposed geophysical surveys. Management measures to discourage the spread of pest species should be established. These measures are likely to include:

- Consultation with relevant authorities and stakeholders.
- Wash down of vehicles and equipment prior to entry onto the Anangu Pitjantjatjara Yankunytjatjara Lands and when moving from areas of known weed infestations.
- Application of pest control measures as required and appropriate management.
- Conducting site based risk assessments to determine the requirement for machinery clean-down when moving between areas.
- Disposal of domestic wastes to avoid the unintentional encouragement of pest animals.

7.6.7 Continuous Improvement

Ongoing performance assessment through monitoring and auditing will result in continuous improvement of systems and operations. Management systems will be the conduit for this process of review and adaptive improvement.

8. CONSULTATION

Ahava Energy has and will continue to conduct focused consultation with stakeholders and other interested parties throughout the development of this EIR and the corresponding SEO, and during the planning of geophysical programs.

Consultation in relation to petroleum exploration and potential future development has essentially been ongoing on the Ananngu Pitjantjatjara Yankunytjatjara Lands for several months. In 2008, prior even to the application of Ahava Energy to commence seismic activities on the Lands, the Ananngu Pitjantjatjara Yankunytjatjara Executive Board took active steps to commence planning for the social development of the Lands that may be prompted by petroleum exploration and potential future resources development on the Lands.

Ahava Energy has participated in numerous forums in which the future development objectives of Ananngu Pitjantjatjara Yankunytjatjara and Ahava Energy have been explored. On several occasions, Ananngu support for petroleum development on the Lands has been expressed[1]. It is understood both parties – Ananngu Pitjantjatjara Yankunytjatjara and Ahava Energy – have agreed to collaborate to ensure such exploration and other future activities are conducted in a way which is aligned to the aspirations and needs of the Ananngu Pitjantjatjara Yankunytjatjara Lands communities and helps maximise the benefit for those communities.

Further consultation, specifically with Traditional Owners and the Ananngu Pitjantjatjara Yankunytjatjara Executive Board is planned to occur in relation to seismic activities on PELAs 148 and 147.

8.1 Key Stakeholders

Stakeholders identified as having a direct interest in the proposed geophysical survey in the Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin can be summarised as follows:

- Ananngu Traditional Owners and their representative Ananngu Pitjantjatjara Yankunytjatjara Executive Board.
- State government regulatory agencies and peak industry bodies.
- Other interested parties.

Stakeholders were briefed of the proposed geophysical survey on the Ananngu Pitjantjatjara Yankunytjatjara Lands and asked to comment on a draft of both the EIR and SEO regarding the proposed seismic activities.

Table 8.1 provides a summary of stakeholder engagement and consultation conducted during the development of this EIR.

[1] The Challenge of Change workshop, Adelaide, 17 March 2009, Ahava Thanksgiving celebrations, Marla, 26 February 2009, APY Executive Board Meeing, Indulkana, 4 February 2009.

Table 8.1 Consulted stakeholders

Stakeholder Type	Organisation/ Agency
Priority 1 Land Owners	Ananngu Pitjantjatjara Yankunytjatjara Lands Executive Board
	Key regional Traditional Owners
	Ananngu Pitjantjatjara Yankunytjatjara Land Management Unit
Priority 2 Stakeholders	Department of Primary Industries and Resources of South Australia (PIRSA)
	Department of Defence
	Department of Water, Land and Biodiversity Conservation (DWLBC)
	Department for Environment and Heritage
	Planning SA
	Environment Protection Authority (EPA)
Priority 3 Others	Department of Health
	Friends of the Great Victoria Desert
	Native Vegetation Council
	South Australian Native Title Services (SANTS)
	Terrex Seismic

8.2 Landowner Consultation

Coffey Natural Systems, on behalf of Ahava Energy, has undertaken and coordinated stakeholder engagement and consultation with the Ananngu Pitjantjatjara Yankunytjatjara Executive Board, the relevant Traditional Owners and Ananngu for the purposes of this EIR.

Engagement and consultation with Ananngu aimed to:

- Detail the proposed activities, their location and potential environmental and social impacts that may occur as a result of the activities in an honest and transparent manner.
- Provide an opportunity for Ananngu to express views and concerns related to the proposed activities, and to indicate their approval, or otherwise of the planned activities.
- Establish a relationship between Ahava Energy and Ananngu that is conducive to a long and mutually beneficial working arrangement and the open communication of concerns and issues.

A number of consultation sessions on the Ananngu Pitjantjatjara Yankunytjatjara Lands were carried out in order to achieve the above consultation objectives. They are explained below:

Seismic demonstration and thanksgiving ceremony

Ahava Energy, in conjunction with seismic consultants Terrex Seismic, conducted a seismic demonstration south of Marla in February 2009. Traditional Owners were invited to attend. The presentation aimed to introduce Ahava Energy to the Traditional Owners, explain methods of seismic exploration and to demonstrate the seismic equipment and how it is used.

The demonstration concluded with a thanksgiving ceremony in which executives of Ahava Energy outlined their desires to work collaboratively with Ananngu for the mutual benefit of both parties on the Ananngu Pitjantjatjara Yankunytjatjara Lands.

The event was attended by approximately 200 people and included traditional dance and singing performed by Ananngu.

Annual General Meeting

The annual general meeting (AGM) of the Ananngu Pitjantjatjara Yankunytjatjara, held in March 2009, included a lengthy discussion about the implications of petroleum exploration on the Ananngu Pitjantjatjara Yankunytjatjara Lands. The AGM, held over two days, was attended by 95 Ananngu, from 10 communities and 10 homelands across the Lands.

Executive Meetings

The Executive Board discussed petroleum exploration in the context of broader social development at its meeting in February 2009. At its April 2009 meeting, a discussion was held to ascertain concerns about seismic exploration on the Lands, areas to be excluded from seismic exploration and to identity of any additional Traditional Owners that had not yet been consulted.

Consultation specifically for the preparation of EIR, SEO

A meeting of Traditional Owners and Ananngu particularly interested in PEL 138 was held on Wednesday 22 April 2009. A presentation was given by members of the Anangu Pitjantjatjara Yankunytjatjara Management Team and interpreted by Executive Board Chairman Bernard Singer. The presentation and subsequent discussions aimed to ensure that the community and Traditional Owners for PEL 138 were fully informed of the proposed activities, the proposed locations and the impacts that may arise from those activities, details about Ahava Energy and the regulatory process required for the activities to proceed.

Further consultation of this nature will be conducted as and when exploration activities move into PELAs 147 and 148.

Source: Coffey Natural Systems

Plate 8.1
Seismic demonstrations

Source: Coffey Natural Systems

Plate 8.2
Consultation with Traditional Owners

Source: Coffey Natural Systems

Plate 8.3
Consultation with Traditional Owners

8.3 Government Agencies and Relevant Bodies

As outlined in Table 8.1 Consulted Stakeholders, relevant State government regulatory agencies and other relevant bodies were invited to provide comment on the draft EIR and SEO prior to its finalisation. In particular, agencies and other relevant bodies were asked to assist in the formulation, and/or perceived appropriateness, of mitigation measures for identified potential impacts. Comments and responses to comments received are provided in Section 8.5, Stakeholder Comments and Responses.

8.4 Continued Consultation

Ahava Energy will continue consultation with relevant stakeholders throughout the course of its geophysical surveys on the Anangu Pitjantjatjara Yankunytjatjara Lands to address any potential issues or concerns arising during the activities.

8.5 Stakeholder Comments and Responses

Table 8.2 provides a summary of the stakeholders engaged and their comments regarding the proposed geophysical surveys in the Anangu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin. The table includes a responses to these comments/issues, where required.

Table 8.2 Stakeholder comments regarding the proposed seismic exploration in Ananngu Pitjantjatjara Yankunytjatjara Lands region of the Officer Basin and response to EIR and SEO

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
1	Miscellaneous	Minor grammatical changes required	Actioned. All grammatical changes have been amended to both the EIR and SEO.
2	Traditional Owner of the Officer Basin region of the Ananngu Pitjantjatjara Yankunytjatjara Lands	Everybody is happy for the project to go ahead, in principal the relevant Traditional Owners say yes.	Noted.
3	Traditional Owner of the Officer Basin region of the Ananngu Pitjantjatjara Yankunytjatjara Lands	We are happy to proceed with the project. We believe that the project will be good for future generations and in providing employment and education to Ananngu.	Noted.
4	Traditional Owner of the Officer Basin region of the Ananngu Pitjantjatjara Yankunytjatjara Lands	We are happy to proceed with exploration around Mintabie and Walatina, however further consultation would be required if any activities are proposed north of Mt John.	Noted. No exploration is planned for areas north of Mt John
5	Traditional Owner of the Officer Basin region of the Ananngu Pitjantjatjara Yankunytjatjara Lands	Marsupial moles were once present in the area but have not been seen for years.	Noted.
6	Traditional Owner of the Officer Basin region of the Ananngu Pitjantjatjara Yankunytjatjara Lands	If drilling is done at a later date, we request that water wells are left open for Ananngu use.	Noted, no drilling is proposed in the present survey; however the drilling of wells would be addressed in additional SEO if drilling commences.
7	Traditional Owners of the Officer Basin region of the Ananngu Pitjantjatjara Yankunytjatjara Lands	We have experience of seismic exploration in the local area and are aware of the potential impacts	Noted.
8	Ananngu Pitjantjatjara Yankunytjatjara Management	Section 4.8 Land use, make the following addition: "A game meat processing facility is being constructed at Double Tank, near Kaltjiti, and should be operational by mid-2009. This will help to reduce the overall impact of camels on the APY Lands."	Actioned. An amendment to the EIR to reflect this comment has been made. See Section 4.8.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
9	Anangu Pitjantjatjara Yankunytjatjara Management	Section 8.2 Annual General Meeting, make the following amendment: The attendance at the March 2009 AGM, held over 2 days, was attended by 95 Anangu members, from 10 communities and 10 homelands from across the APY Lands.	Actioned. An amendment to the EIR to reflect this comment has been made. See Section 8.2.
10	Anangu Pitjantjatjara Yankunytjatjara Mining Tenement Officer	The EIR should reflect the proposal for a new Indigenous Protected Area at Sandy Bore adjacent Walalkara Indigenous Proclaimed Area.	Actioned. An amendment to the EIR to include the proposed Sandy Bore Indigenous Proclaimed Area has been made. See Section 2.3.
11	Anangu Pitjantjatjara Yankunytjatjara Mining Tenement Officer	There may be unrecorded malleefowl and their nest mounds in the PEL. Expert assistance will be required in identifying nest mound sites. Conserving malleefowl nest sites along with great desert skink burrows would have to be one of the highest priority objectives.	Actioned. See Section 5.1.5, environmental clearance protocols and SEO Objective 3. For all future proposed seismic exploration activities proposed by Ahava Energy on the Lands an environmental clearance team may be employed to identify mallee fowl, mounds and habitat and great desert skink habitats so that these can be avoided by exploration activities.
12	Friends of the Great Victoria Desert	No exploration should take place within any South Australian designated parks or reserves. Our view differs from the Government position in this area - we are opposed to any mining or exploration activity in those parks in the Great Victoria Desert in which such activity is currently permitted.	Noted. There are no proclaimed parks or reserves within the proposed seismic survey area in PEL 138. Specific information relating to exploration in parks and reserves is detailed in Section 2.3, including details of the location of the nearest parks and reserves.
13	Friends of the Great Victoria Desert	Mining vehicles and personnel travelling through the parks to get to the exploration tenements should have either zero or a positive impact on the park environments. Subject to consultation with the parks service, careful grading of established tracks (e.g., the Anne Beadell Highway) to improve current erosion and runoff problems is an example of a way in which this travel could have a positive impact.	Noted. No travel is proposed through any parks or reserves for the proposed exploration in PEL 138 on the Anangu Pitjantjatjara Yankunytjatjara Lands. If exploration vehicles were required to move though any parks and reserves a policy of minimal, zero or a positive impact would be employed.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
14	Friends of the Great Victoria Desert	All exploration and mining activity in the Great Victoria Desert outside the designated parks and reserves should be undertaken with minimal impact and full remediation programs should be in place. I have limited expertise in this area, but it seems that the documentation you have provided covers these aspects comprehensively. It is important, however, that the promised low-impact operations and remediation programs are actually implemented.	Noted. Ahava Energy only use highly experienced geophysical survey consultants. These consultants commit to environmental best practice as detailed in Section 5.3 and other industry standards such as the APIA code of conduct. Ahava Energy and their consultants have formulated the Objectives detailed in Attachment A of the SEO (in consultation with government departments) to ensure that all risks associated with geophysical activities are managed to reduce the impacts to the environment and the community. Additionally the *Petroleum Act 2000* states that an objective of the Act is that rehabilitation of land adversely impacted by regulated activities (such as seismic surveys) must occur. Failure to remediate land affected by regulated activities would therefore be a breach of the Act.
15	Friends of the Great Victoria Desert	Friends of the Great Victoria Desert enjoys positive relationships with the Traditional Owners of the areas in which we travel. We do not wish to comment on the arrangements between mining companies and those owners, other than to note that company personnel should always consult the Traditional Owners if there is any doubt that their activity might contravene the letter or intent of those arrangements.	Noted. Extensive consultation regarding the proposed exploration activities has occurred with the Anangu Pitjantjatjara Yankunytjatjara Lands Executive Board and the relevant Traditional Owners on those lands proposed for exploration (See section 8). Additionally, a land access agreement has been formed between Anangu Pitjantjatjara Yankunytjatjara and Ahava Energy (see Section 3.1). The land access agreement specifies the terms by which Ahava Energy may enter and ulilise those lands. A breach of the land access agreement would also be a breach of the SEO and therefore the *Petroleum and Geothermal Act 2000*
16	DEH	Inclusion of a DEH biological database should be discussed with DEH (Kirsty Beavan). A search based on the outline of the relevant PELAs would not be too bad, there seems to be a reasonable number of records. Buffer areas outside the licence areas representing the same habitat types and landforms from the region may be useful to pick up other species likely to occur.	Actioned. See Figure 4.1 and comment 21.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
17	DEH	The EIR identifies the major landforms of the region and notes flora and fauna associated with them but regional vegetation mapping would provide more detail in terms of vegetation types and composition as well as geographical extents for access and impact minimisation planning.	Actioned. Minimial vegetation mapping for this area is available as detailed from a DEH biological data request, however all floral species that have been recorded in the PEL and PELAs as determined by the DEH biological data request is presented in Appendix A and B.
18	DEH	Under 'Compaction' Section 5.3.1: 'following in previous off-line wheel tracks is banned'. This is inconsistent with the ban on off-line driving. Although compaction may be avoided by not following in existing wheel marks, further disturbance may occur by the creation of new wheel marks.	All Terrex vehicles operating in the field are instructed to use existing approved access tracks (inc seismic line). Unless otherwise directed by landowners or client. This can be in most cases determined on a day to day basis due to the severity of ground disturbance. Similarly; direction may be given by the landowners or client to restrict access to some tracks and open use to others. Terrex vehicles are not permitted to drive off the seismic line or use unauthorised tracks and roads. However; when a vehicle is required to pass another vehicle, the driver is encouraged to identify a clear area to pull off to the side and stop to allow a vehicle to pass by. Three point turns are the approved method to turn a vehicle around on the seismic line, ensuring the area is free from obstacles.
19	DEH	Creeks lined with River Red Gums, in particular, are important breeding habitat for many bird species, including scheduled species. Measures for minimising disturbance and access to these areas should be adopted, with known raptor nest-sites avoided during the breeding season.	Actioned. See Objective 3.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
20	DEH	Table 7.4. 'Preparations of lines and access tracks': • Currently states 'Disturbance or loss of vegetation and habitat' is *Possible*. This should be *Almost certain* with a resulting Risk of *High.* • Facilitation of third party access' is given as *Unlikely* and should be *Possible* resulting in a Risk of *Medium.* • Provision of passage to invasive fauna species and predator species should be *Possible* rather than *Unlikely* with the same resulting Risk of *Medium.* 'Campsites and associated materials': • A potential consequence is also the introduction, promotion or dispersion of weeds and ferals. • Disturbance or loss of vegetation and habitat' should be *Minor*, *Likely* with a Risk of *Medium* (currently *Moderate, Unlikely, Medium*). • Disturbance or loss of vegetation and habitat by fire' should be *Unlikely* rather than *Possible.* • Attraction of native fauna to food scraps'. The potential consequence of concern is more the attraction of feral species and should be *Moderate, Possible, Medium.* For all weed-related consequences in this table, it is not just dispersion of weeds that is an issue, but the promotion of weed growth via soil and vegetation disturbance.	Actioned. See Table 7.4.
21	DEH	Appendices should also list flora as well as fauna.	Rejected. As this information does not further inform the document of key environmental impacts it has not been appended to this document. A list of all flora and fauna species recorded in the area will be provided to the contractor prior to commencement of work.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
22	DEH	PEL 138 abuts Tallaringa conservation park and Ahava Energy's PELA 147 also abuts Mamungari conservation park and this deserves inclusion here under 'Existing Environment' with any potential risks dealt with in the risk assessment and objectives, e.g. accidental incursion.	Actioned. Details of Mamungari and Tallaringa conservation park in the context of the proposed exploration in PEL 138 have been included into Section 2.3 and Table 7.4.
23	DEH	For the SEO, how is removal of mature trees defined? Retention of root stock is already an aim, so does this mean pushing over trees with the blade up or similar is out, or does this only mean removal out of the ground altogether?	A common definition of a tree is "A single-trunked plant with a sufficient, recognisable girth with numerous secondary branches definably clear of the ground and above three metres in height. Only some mulgas and mallees on the Lands are likely to fit into this definition. Given the experience gained from the Welbourn Hill 2D Seismic Survey, it is acknowledge that in areas of dense mulga woodland, there is no practical way to ensure that mature mulga will not be removed during line preparation for seismic surveys in PEL(A)s. Therefore removal of mature trees should occur only when unavoidable, and when weaving, detours and other mitigation strategies do not afford practical access. See Objective 3 of the SEO With reference to the comment on retaining rootstock - this is not an objective but one of many standard operating procedures that are designed to achieve an objective - in this case "to minimise the impact of operations on vegetation"
24	DEH	I note the existing Officer Basin SEO (Officer Basin Energy Pty Ltd) has "Flora and/or fauna surveys may be undertaken in association with proposed field activities" in column 3 for this objective. Something like this could be refined in terms of triggers for survey or further assessment.	Actioned. See Objective 3 of the SEO. In addition a separate section regarding environmental clearance has been added to the EIR (See Section 5.1.5).

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
25	DEH	Minimise disturbance to native vegetation and fauna: Guide to achieving objectives' mentions avoiding known locations of scheduled species where possible, an appropriate measure. There may also be a need for specific assessments of impacts to scheduled species triggered by records or habitat. For example, if avoidance of a known locality of a scheduled species is NOT possible, further assessments of the risks (sourcing information from vegetation mapping, biological data and information compiled on individual species plus expert consultation in some cases) and/or field survey to determine presence/absence may be required on a case by case basis. The assessments and information on scheduled species in s4.3 of the EIR (once covering all likely species) will provide a basis for identifying species which might trigger further assessments, e.g. those with restricted known distributions which may be more vulnerable to impacts. Conservation needs of specific species have been considered" may cover this in an in-direct way but something more specific in column 3 addressing further assessments on a case by case basis should be included.	Actioned. See Objective 3 of the SEO.
26	DEH	Noted that it would be of value to provide data to DEH regarding evidence of malleefowl (mounds and animal sightings) and other fauna records within the exploration lines.	Actioned. Objective 2 of the SEO details that any sightings of curious fauna (especially malleefowl and their mounds and great desert skinks) will be reported to DEH and APYLMU, GPS coordinates collected and where possible photographs taken.
27	DEH	Is it possible to include fauna which has not been recorded but is a possibility given appropriate habitat and appropriate trapping techniques (e.g., sandhill dunnarts)	Actioned. See Objective 2 in the SEO. If flora and fauna surveys are carried out survey methods will be discussed with DEH and APYLMU.
28	PIRSA	Please include a map depicting bioregions and subregions.	Actioned. See Figure 4.1.
29	PIRSA	Include any other details of historical mining in Section 4.6 Non-Indigenous Heritage	Actioned. See Section 4.6.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
30	PIRSA	Does the number of cattle described in Section 4.8 conflict with ABS statistics.	Yes. Australian Bureau of Statistics 2006 statistics are now out of date and it is advised by APYLMU that the statistics presented in Section 4.8 represent the number of cattle in the PEL 138.
31	PIRSA	Discussion regarding the visual impact of cutting lines needs to be further discussed in section 5.3.1, as it may be likely that such weaving leads to a greater land surface impact (scalloping) in some areas and the strategy needs to be changed for such affected areas.	Work sponsored by Ahava Energy and PIRSA was done to further inform the industry regarding the impacts to soil and visual amenity relating to line cutting. The results indicated that excessive weaving will have more substantive impacts. Smoothly weaving of a line will have little impact on the acreage affected compared to a straight line. Weaving to avoid vegetation and use ground conducive to vehicular trafficking will achieve multiple objectives including reducing visual impact.
32	PIRSA	Comment regarding the dot point discussed in 5.3.1 “all vehicles are thoroughly cleaned to prevent the introduction of weeds into the survey area”. Is this a defined requirement? Should it be a required inspection first, and a risk assessment to determine whether the vehicle needs to be cleaned (and to what level of cleaning is required – brushing, washing, chemical washing)?	Actioned. A new section has been added to the EIR Section 5.3.8 detailing industry best practice operating procedures for prevention of the spread of weeds and pathogens and is based on the DEH SA standard operating procedure for the prevention of spread of Buffel Grass Objective 6 of the SEO reflects the changes made to Section 5.3.8.
33	Department of Health	Risk control/ management issues to ensure that the public, e.g. Anangu are not endangered are not mentioned in any great detail. 7.6.2 refers to emergency response plans but there is no further information in either of the two documents.	Actioned. See Objective 2 of the SEO.
34	Department of Health	As the camps will serve food as part of employment they will become a commercial kitchen and as such will need to comply with the food safety standards. The camps will need to be inspected as part of the regular food safety regime. Further information on this requirement can be found at the following website. http://www.dh.sa.gov.au/pehs/food-index.htm	Not applicable to the geophysical operations in PEL 138. Terrex will not be using a camp. Accommodation, catering and ablutions will be provided by Marla Traveller’s Rest facilities.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
35	Department of Health	The EIR, page 5-39 contradicts itself. Dot point 6 states that waste water is disposed of by drainage channels and seepage pits but the next dot point states that it is important that waste water is not allowed to freely permeate the soil.	See comment 34.
36	Department of Health	Dot point 10 page 5-39 states that mobile toilets are used on all camps. There is no information provided as to how the chemical waste will be disposed of as it cannot be put into either an aerobic system or a septic tank soakage system. The method of disposal of chemical toilet waste needs to be included, if they are to be used	See comment 34.
37	Ahava Energy	The licensee will ensure, when preparing an Environmental Impact Report under Part 12 of the Petroleum Act 2000, that the report also includes an assessment of the potential economic consequences for other licensees under the Petroleum Act 2000 or Mining Act 1971 and owners of the land, arising out of proposed regulated activities to be carried out in the licence area."	Section 4.8 details all of the economic activities that occur in PEL 138. The proposed geophysical surveys will not impact upon any of the economic activities or other licence holders in PEL 138. All of the commercial ventures on the Lands are known to Ahava. These ventures have been consulted and will not be impacted by the proposed geophysical surveys. Objective 2 details the approach to managing any potential economic impacts to the land owners.
38	Anangu Pitjantjatjara Yankunytjatjara Land Management	There is potential for a number of threatened species to exist in the proposed area BUT there have not been surveys to confirm this (the Biological Survey of the APY Lands very poorly examined most of the area covered by the PELAs). Recent vegetation assessments of the other parts of the Lands have shown that the vegetation maps that are currently available are not adequate and we can not predict the location of threatened flora and fauna based on vegetation maps.	Actioned. See comment 24 and 25.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
39	Anangu Pitjantjatjara Yankunytjatjara Land Management	I would suggest that general observations by Traditional Owners during anthropological clearances are not adequate as a fauna survey/environmental clearance. Suggest that expert Anangu Tjakura trackers are employed to assess suitable habitat for the presence of this endangered species. Similarly, there have been recent reports of mallee fowl in the area which need confirmation. The trackers would need to work in a team of two at the minimum.	Actioned. See comment 24 and 25.
40	Anangu Pitjantjatjara Yankunytjatjara Land Management	Tracks of any sort are utilised by feral predators. They therefore provide an opportunity for an increase in predation on threatened species populations and there is significant evidence across Australia for this. Predator numbers should therefore be monitored before and after survey lines are installed. It would be great if this could work in with other predator monitoring in the APY Lands so that data is comparable.	Actioned. See Section 5.1.5 Environmental Clearances and Objective 6.
41	Anangu Pitjantjatjara Yankunytjatjara Land Management	The potential for the spread of weeds needs serious consideration and it is not clear from the EIR/SEO what AHAVA's machinery hygiene procedures are and whether they are adequate. SA DEH has recently release some recommendations on this (contact Amber Clarke clarke.amber@saugov.sa.gov.au).	Actioned. See comment 34.
42	Anangu Pitjantjatjara Yankunytjatjara Land Management	*Amytornis striatus*, striated grasswren (*Amytornis textilis modestus*) is more likely to occur in the region than thick-billed grass wrens (and is listed under state legislation	Actioned. This species and all other scheduled species under state and federal environmental legislation which have been recorded or their habitats occur in the area have been included in Section 4.6.
43	Anangu Pitjantjatjara Yankunytjatjara Land Management	Details of ongoing monitoring in the Walalkara IPA should be included in Section 4.8.1	Noted.
44	Anangu Pitjantjatjara Yankunytjatjara Land Management	Cultural heritage surveys have been described but not environmental clearances	Actioned See comment 24.
45	Anangu Pitjantjatjara Yankunytjatjara Land Management	Section 5.1.8 Potential for all wastes (recyclable and non-recyclable) should be removed from the APY Lands as per the proposed APY lands Waste Management strategy.	Actioned see Section 5.1.9 and Objective 7.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
46	Ananngu Pitjantjatjara Yankunytjatjara Land Management	Section 5.1.11 Post survey monitoring and auditing should utilise monitoring points installed by SA DEH, the pastoral board and APY Land Management if available to enable long term trends to be assessed.	Actioned see Objective 3.
47	Ananngu Pitjantjatjara Yankunytjatjara Land Management	Review and include SA DEH machinery hygiene recommendations. This is critical as communities and current roads in the APY lands are infested with weeds that could be dispersed along lines.	Actioned see comment 32
48	Ananngu Pitjantjatjara Yankunytjatjara Land Management	Preparation of lines will create greater access to predators; This is a significant threat that needs serious consideration considering the potential for threatened species in the region and the lack of biological surveys.	Actioned see comment 40.
49	Ananngu Pitjantjatjara Yankunytjatjara Land Management	Table 7.4 Dispersion of weeds and pathogens and provision of passage to predator species have been changed to a high risk for line surveying and preparation of lines.	It can be argued that with an accepted inspection and cleaning process, risk can be mitigated to a medium. (See comment 32)
50	SA Native Title Services	Where the issues are listed, Ananngu and heritage both appear almost at the end of the lists.	Actioned.
51	SA Native Title Services	Aspects of consultation alluded to are not detailed in any useful way for Ananngu reference or other party's references (like the Governments).	Note: The respondent was commenting on an early exposure draft that had yet to be inputted with consultation activities undertaken. Refer to Section 8 for full consultation activities undertaken.
52	SA Native Title Services	Ananngu are, by default, in the bottom rung of consideration throughout instead of the top rung. The position and significance of APY lands in the entire scheme of things for this proposed ILUA (sic) is almost neutralised.	Rejected. Note: clarification was received from the respondent regarding reference to ILUA (rather than EIR).
53	SA Native Title Services	I would have thought that an ILUA (sic) over such a large area of land and over Aboriginal Land moreover, ought to be considered a precedent.	Actioned. Precedence noted in Section 2.3 and Executive Summary.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
54	SA Native Title Services	Details of the ILUA (sic) would need to be looked at carefully for information about how the proponent is suggesting Heritage clearances will be funded and what is the reporting regime required by them AND accepted by APY.	Noted. This information is described in detail in the conjunctive land access agreement 2009.
55	SA Native Title Services	There is no specific reference to the detailed petroleum agreement between AP and Shell during the 1980s. The point of that is that a lot of work was done in terms of agreement negotiation, training protocols, and rules for field procedure, rules for reporting sites of significance, fieldwork, consultation with proponent staff and management and the like.	Actioned. See Section 2.4. Shell has not, to date, operated on the Anangu Pitjantjatjara Yankunytjatjara Lands. This comment may refer to the Access and Cooperation Agreement between Amoco and Anangu Pitjantjatjara for seismic surveys in PEL 29 (now PEL 138) in 1985.
56	SA Native Title Services	No reference to previous work and a considerable number of Reports of Seismic clearances on areas within the PEL. Such material should at least be noted in general as that which will be (or has been) consulted by APY in order to assist the smooth working of this current proposal.	Actioned. See Section 2.4.
57	SA Native Title Services	Description of process and communication protocols of WACs [work area clearances] vis the proponent and workers in the field.	Noted. Described in detail in the conjunctive land access agreement 2009.
58	SA Native Title Services	*Landholder Consultations* ought to be revised to landowner.	Actioned.
59	SA Native Title Services	The entire Section 8 ought to be revised with all of its sub-sections being incorporated with a view towards noting the schedule so far of meetings/consultations.	Note: The respondent was commenting on an early exposure draft that had yet to be inputted with consultation activities undertaken. Refer to section 8 for full consultation activities undertaken.
60	SA Native Title Services	Point 8.7 needs to be expanded with proposed schedules, terms of arranging consultation, personnel involved from proponent, APY, etc.	See comment 59.
61	SA Native Title Services	All lists of possible affects need to be substantially revised with Anangu and heritage being noted as of top priority.	Actioned.
62	SA Native Title Services	There needs to be a comprehensive section re: confidentiality and ownership of ALL cultural information collected during the WACs and in any other circumstances relating to this proposal. This section should include provisions for proper storage of information, digital, map, genealogy, sites and the like.	Noted. Described in detail in the conjunctive land access agreement 2009.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
63	EPA	Section 3.3. Please note that the EPA is also part of the internal review process for all EIR and SEOs	Actioned.
64	EPA	Section 5.1.9, Camp sites and associated supplies. Wastes The EPA believes that wastes generated at camps, are considered an environmental risk due to the consolidation of staff and operational activities in one location for a period of time. The EPA's Waste Hierarchy model (avoid, reduce, reuse recycle, recover, treat, dispose) should be complied with. Containers subject to deposit legislation, along with other plastics, cans and glass are recyclable and should be segregated on site and transported to a licensed waste transfer facility, Clean paper and cardboard should also be managed in this manner. All other wastes, including putrescibles wastes, must be collected, segregated and disposed of at an EPA licensed facility, licensed to accept the waste. The proponent in Section 5.1.8 has committed to the EPA's requirement as indicated above.	Actioned. See Objective 7 of the SEO.
65	EPA	Bunding and spill management The proponent should refer to the EPA Guidelines 080/07 Bunding and Spill Management (June 2007), for guidance on bunding requirements. A copy of the guideline can be obtained from www.epa.sa.gov.au/pdfs/guide_bunding.pdf Appropriate staff must receive adequate training in the use of spill response equipment, to ensure spills are managed appropriately (including spills from equipment and vehicles). Any contaminated material must be collected and disposed of at an EPA licensed facility, licensed to accept the material. The EPA does not support the proposal to chemically treat and rip ground contaminated by spills.	Actioned. See Section 5.1.9.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
66	EPA	Sewage Treated sewage waste water must comply with the Environmental Protection (Water Quality) Policy 2003. Clause 11 of the Policy states: General obligation to avoid discharge etc. into waters. A person who is undertaking an activity, or is an occupier of the land, must take all reasonable and practical measures (not being measures that themselves cause environmental harm) to avoid the discharge or deposit of waste from that activity or land-into any eaters; or onto land in a place from which is reasonably likely to enter any waters (including by processes such as seepage or infiltration or carriage by wind, rain, sea spray, or stormwater or by the rising of the water table. And, in taking those measures, must apply the waste management hierarchy,	Actioned. See Objective 7 of the SEO.
67	EPA	Waste water The proponent has referenced EPA Guidelines 509/04. The proponent should refer to this guideline during the construction and management of evaporation ponds for the disposal of waste water from laundry, showers and kitchen activities. A copy of the EPA Guidelines 509/04, wastewater and evaporation lagoon construction, can be obtained from www.epa.sa.gov.au/pdfs/guide_lagoon.pdf Where low pollutant loads of waste water from laundry, showers and kitchens are likely, the construction of evaporation pond for disposal of this material can be undertaken with less stringent requirements It is important that waste water is not allowed to freely permeate soils and evaporation ponds must not be constructed close to areas where sensitive landforms and surface waters are located or may occur.	Noted and Actioned. Objective 7 reflects these comments.
68	EPA	The EPA is in agreement with the Low Environmental Impact Classification of the application provided	Noted.

No.	Agency of Individual	Issues and comments raised	Response to issues and comments
69	DWLBC	All activities undertaken under this proposal should conform to the Petroleum Act 2000 and Environmental Protection Act 1993 in accordance with the SEO.	Noted, however section 7(4)(a) of the Environment Protection Act 1993 provides for an exemption for exploration activities operated under the Petroleum Act 2000.
70	DWLBC	All chemicals must be stored appropriately (i.e., in lined, bunded areas). Bunded areas must have freeboard to hold a 1 in 100 year, 24hr rainfall event.	Actioned. See Objective 7.
71	DWLBC	The area of the lease is contained within the Alinytjara Wilurara Natural Resource Management Board (NRM board) area and as such, PIRSA Petroleum must take into consideration issues raised within the Alinytjara Wilurara Initial Natural Resource Management Plan (INRM Plan)	Noted.
72	DWLBC	It is understood that PIRSA Petroleum consults the NRM Board on medium impact activities or higher, because exploration involves almost no environmental impact. However if a discovery is made and further testing is required, it is understood that PIRSA Petroleum will consult the relevant NRM Board	Noted.
73	DWLBC	Although there is no Water Allocation Plan (WAP) relevant to this area, matters of water management, relevant soil conservation plans, relevant animal and plant control board plans, are all contained in the current Alinytjara Wilurara INRM plan. The SEO and EIR appear to be consistent with the INRM Plan.	Noted.

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Attachments

Attachment A List of Relevant Legislation

South Australia

Anangu Pitjantjatjara Yankunytjatjara Land Rights Act 1981

Aboriginal Heritage Act 1988

Dog and Cat Management Act 1995

Environment Protection Act 1993

Fire and Emergency Services Act 2005

Heritage Places Act 1993

National Parks and Wildlife Act 1992

National Trust of SA Act 1995

Natural Resources Management Act 2004

Native Vegetation Act 1991

Occupational Health, Safety and Welfare Act 1985

Petroleum Act 2000

Public and Environmental Health Act 1987

Public and Environmental Health (Waste Control) Regulations 1995

Wilderness Protection Act 1978

Commonwealth

Environment Protection and Biodiversity Conservation Act 1999

Aboriginal and Torres Straight Island Heritage Protection Act 1984.