

Exploration Permits 112, 125, 82, and 105 – Exploration

Program

Environment Plan

Santos

Facility:

Southern Amadeus Basin Exploration

Project Title:

2016 Southern Amadeus 2D Seismic Program



Santos

TABLE OF CONTENTS

1	INTRODUCTION.....	3
1.1	PROJECT LOCATION.....	3
1.2	PROJECT DESCRIPTION.....	3
1.2.1	<i>Sacred Site Protection Procedures</i>	3
2	ENVIRONMENT DESCRIPTION	6
2.1	PHYSICAL ENVIRONMENT.....	6
2.1.1	<i>Climate</i>	6
2.1.2	<i>Hydrology.....</i>	6
2.2	BIOLOGICAL ENVIRONMENT	6
2.2.1	<i>Bioregions, Flora and Fauna</i>	6
2.2.2	<i>Protected or Conservation Areas</i>	6
3	PERFORMANCE OBJECTIVES, STANDARDS AND MEASUREMENT CRITERIA.....	7
4	CONSULTATION.....	15
4.1	STAKEHOLDER IDENTIFICATION.....	15
4.2	STAKEHOLDER CONSULTATION.....	15
5	REFERENCES	16

FIGURES

FIGURE 1-1:	2016 SOUTHERN AMADEUS SEISMIC SURVEY	4
FIGURE 1-2	CLC CLEARED CAMP LOCATIONS.....	5

TABLES

TABLE 3-1:	PERFORMANCE OBJECTIVES, MEASUREMENT CRITERIA, OPERATIONAL CONTROLS AND PERFORMANCE STANDARDS	8
------------	---	---

Santos

1 INTRODUCTION

1.1 Project Location

The Project's proposed seismic activities will be carried out over Exploration Permits 82, 105, 112, and 125 which are located east, south and south west of Alice Springs (The Project Area) (Figure 1-1). These Exploration Permits cover a combined area of approximately 48,100km² of the Amadeus Basin. The Exploration Permits are located on Aboriginal, Leasehold and Freehold land.

1.2 Project Description

Seismic acquisition allows the explorer to 'image' below the surface and identifies areas where oil and gas may have accumulated. The seismic method uses vibrator trucks to produce sound waves, which travel into the earth and are then reflected from subsurface geological structures. The returning reflections are recorded in a digital format and sent to a seismic data processing centre to produce a 'cross-section' of the layers of the earth's crust.

The seismic survey application covers 2514 km but Santos only expect to record approximately 1,300km. The additional kilometres have been permitted to allow for flexibility of program based on results of survey on an ongoing basis.

Once the exploration team have proposed a seismic program, the seismic program is plotted onto detailed topographic and/or satellite images (as shown in Figure 1-1). The proposed work programme and this EP covers only 2D seismic survey activities. A 2D survey records data along a single line of traverse, giving a cross-sectional 'picture' of the subsurface. 2D seismic lines are normally 10km to 50km long, or longer for regional exploration surveys and spaced 500m to 5000m apart

Seismic lines potentially impact a width of 4 to 5m. The seismic lines are laid out with weaving and minimal cutting so as to avoid sensitive environmental sites, significant habitat, as well as cultural features such as buildings, dams, water wells and known Aboriginal heritage sites. Campsites are generally located at the nearest available naturally clear area or previously disturbed areas.

Proposed main campsite locations are shown on Figure 1-2.

Surveying commences shortly after line preparation and recording normally commences two to three weeks after the start of line preparation. This operation is the largest part of the seismic operation in terms of personnel and vehicles. A recording crew would normally consist of up to 34 personnel and 16 vehicles.

Based on current seismic crew availability, Santos would expect to commence line preparation for the project in October 2016, with the seismic recording commencing approximately 3 weeks later. Recording for this project is expected to take approximately sixteen weeks to complete.

Line/Access Track and Campsite Restoration and Post Survey Monitoring and Auditing occur following the surveying

1.2.1 Sacred Site Protection Procedures

As part of the seismic survey planning process, Santos has submitted an application for a Sacred Site Clearance Certificate (SSCC) to the Central Land Council (CLC). The application detailed the proposed project works activities including the project scope, definitive locations, proposed access routes, transportation and campsite locations. The CLC has assessed the application and issued Santos with a CLC SSCC detailing Subject Land, Exclusion Zones, Restricted Work Areas and all conditions.

Santos

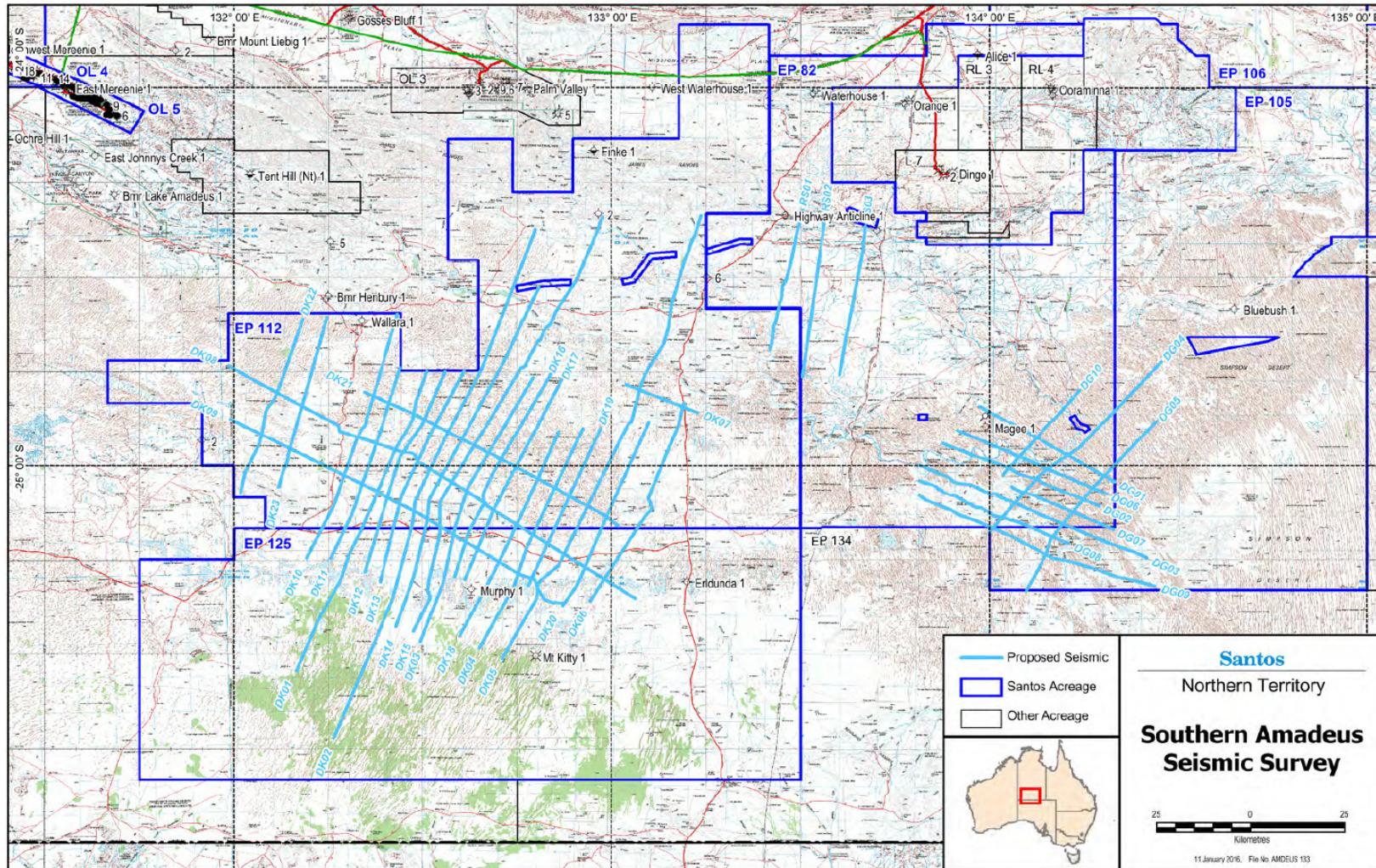


Figure 1-1: 2016 Southern Amadeus Seismic Survey

Santos

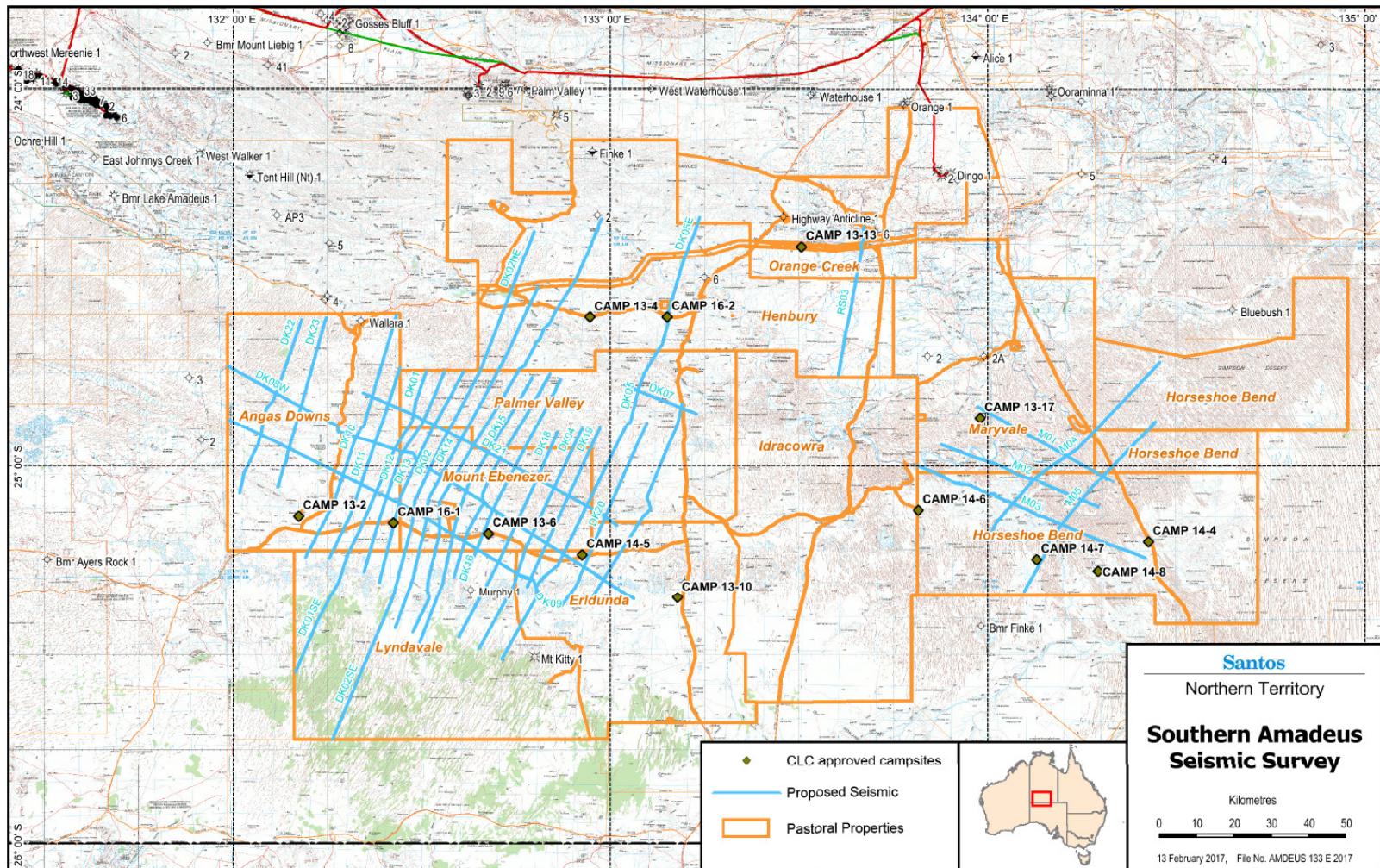


Figure 1-2 CLC Cleared Camp Locations

Santos

2 ENVIRONMENT DESCRIPTION

2.1 Physical Environment

2.1.1 Climate

The Southern Amadeus seismic survey is located within the arid zone of Central Australia that experiences low and variable rainfall and high diurnal and seasonal temperature fluctuations. The mean annual rainfalls for Alice Springs and Mereenie are 284 mm and 300 mm respectively, with the majority of rainfall in summer. Temperatures vary from very hot in summer to below freezing in winter, and frosts occur regularly during the winter months.

2.1.2 Hydrology

All catchments within the Amadeus Basin region drain internally towards Lake Eyre (within South Australia). All surface water including rivers, streams and drainage lines are ephemeral and subject to short flow duration and high turbidity. The dominant basin is associated with the Finke River system and its associated tributaries and feeder rivers.

Salt lakes are a significant landform in the southern part of the Northern Territory, covering an area of some 2,800 square kilometres. Within the Project Area all salt lakes will be avoided by the proposed activities.

The EPBC Act protected matters search identified one nationally important wetland being the Karinga Creek Palaeodrainage System.

2.2 Biological Environment

2.2.1 Bioregions, Flora and Fauna

The Project Area is covered by the bioregions of the Simpson Strzelecki Dunefields Bioregion in the east and Finke Bioregion in the west. The Simpson-Strzelecki Dunefields Bioregion bioregion is part of the Australian continental dunefields, which consist of a huge anti-clockwise whorl of linear dunes in central Australia and thus dominated by high linear dunes of red sand. The main land types of the Finke Bioregion are arid sand plains with dissected uplands and valleys, including some major rivers (Finke, Hugh and Palmer rivers). The bioregion is dominated mulga taking different forms on different soil types.

Within the Arid Lands Region of the NT, there are 76 threatened species, 41 of which are listed as threatened nationally and 70 that are listed as threatened in the Territory. Bednall's Land Snail, listed as Critically Endangered in the NT, is the most severely threatened species that is still thought to occur in the region. The region has 47 species listed as migratory under international agreements.

Pest animals identified in the region include rabbits, feral cats, pigs, donkey and camels.

2.2.2 Protected or Conservation Areas

There are protected or conservation areas within in Project Area (DLRM 2014a). These protected areas will all be avoided by the Program.

Santos

3 PERFORMANCE OBJECTIVES, STANDARDS AND MEASUREMENT CRITERIA

The objectives described in the Environment Plan (EP) are based on operational information detailed in the *South Australia Cooper Basin and Arid Regions, Environmental Impact Report: Geophysical Operations* (Santos, 2012a) (EIR), and while consistent with those contained in the *South Australia Cooper Basin and Arid Regions Statement of Performance Objectives: Geophysical Operations* (Santos, 2012b), the objectives have, where appropriate, been amended to reflect the specific characteristics of the Southern Amadeus environment.

Table 3-1 details the performance objectives defined for this project; the measurement criteria that will be used to assess these objectives; and the operational controls that will be implemented for the project. Santos has defined 10 performance objectives for the Southern Amadeus 2D seismic survey. The performance objectives are:

1. Minimise the visual impact of seismic operations;
2. Minimise disturbance to and contamination of soil resources;
3. Minimise disturbance to native vegetation and native fauna;
4. Avoid disturbance to sites of cultural, sacred and heritage significance;
5. Minimise disturbance to livestock, pastoral infrastructure and landholders;
6. Avoid the introduction or spread of exotic species and implement control measures as necessary;
7. Minimise disturbance to drainage patterns and avoid contamination of surface waters and shallow groundwater resources;
8. Optimise (in order of most to least preferable) waste avoidance, reduction, reuse, recycling, treatment and disposal;
9. Remediate and rehabilitate operational areas as necessary; and
10. To generate no fires from the Seismic Operations.

Santos

Table 3-1: Performance objectives, measurement criteria, Operational Controls and Performance Standards

Performance Objective	Operational Controls	Measurement Criteria
<u>Objective 1:</u> •Minimise the visual impact of seismic operations	<ul style="list-style-type: none"> •Pre-survey planning to minimise visibility of operations with the use of Santos' GIS. •Maximise use of vegetation or landforms to disguise operations. •Avoid extensive side cuts. •Lines are prepared to a single blade width only (approximately 4m to 5m). •Lines are weaved at least every 75m to 100m about the general line of traverse and stands of vegetation. •Lines are doglegged at road and track crossings preferably around vegetation. •Dozers are walked with blade up wherever possible. •All litter is to be managed and disposed of correctly. 	<ul style="list-style-type: none"> •Pre-survey planning has been undertaken to minimise visibility of operations and records are available for audit. •Seismic survey lines and campsites have been appropriately located and prepared to minimise the visual impact. •No litter remains at camps. •EMPs are selected from photo points where additional monitoring is deemed appropriate.
<u>Objective 2:</u> •Minimise disturbance to and contamination of soil resource	<ul style="list-style-type: none"> •All windrows are removed either during or on completion of work. •Areas subject to inundation will be assessed for conductiveness to support vehicles. •Blade work is banned on naturally smooth surfaces or flat easy terrain. Minimal blade work is permitted elsewhere for access. •Camp sites are positioned close to existing roads where possible and are ripped, if necessary, on completion of work. •Creek bank vegetation is left intact and detours sought if too dense to pass through. •Off line driving for the main crew is prohibited – no bush bashing or short cuts are permitted. •Operations are shut down during wet weather or flooding and only restarted once potential for extensive damage has passed. Unavoidable damage is reinstated on completion of work. •EMPs will be established to monitor and document soil disturbance and recovery. •Where required, access tracks will be watered and is reinstated after use. 	<ul style="list-style-type: none"> •Proposed survey lines and campsites have been appropriately located and prepared to minimise the disturbance to soil resources. •Survey planning has been undertaken to minimise impacts of operations and records are available for audit. •No refuelling occurred outside designated refuelling / servicing areas. •Spills or leaks were managed and clean up actions initiated. •Records of spill events and corrective actions are maintained

Santos

Performance Objective	Operational Controls	Measurement Criteria
	<ul style="list-style-type: none"> •The number of camp sites will be minimised with the aim being to share existing sites wherever reasonably practicable. •Unavoidable compaction in areas other than those susceptible to erosion, will be ripped on completion of work. •Where possible, existing tracks, roads or seismic lines will be used for access. •Use of road tanker fuel storage. •Use of drip trays for transfers. •Any spills have been contained and retrieved. •Oil spills areas will be ripped to an appropriate depth. •All fuel stored and used should be under the control of qualified or trained personnel. •Fuel and other lubricants will be appropriately stored and managed. 	<p>in accordance with company procedures.</p> <ul style="list-style-type: none"> •Appropriate spill response equipment is available on site. •Fuel storage (>10,000L) contained within double skin tanker with safety valves. •Appropriate containment bunding for site drum storage (up to 200L) protection is implemented. •EMPs are selected from photo points where additional monitoring is deemed appropriate.
<u>Objective 3:</u> <ul style="list-style-type: none"> •Minimise disturbance to native vegetation and fauna 	<ul style="list-style-type: none"> •Terrain and vegetation is considered in planning stage when designing layout of the survey. •Camp sites are established in locations where the preparation of a new access track is not necessary or is minimal in length. •Off line driving is banned – no bush bashing or short cuts are permitted. •Vehicle access to survey lines is to be via existing access tracks or pre-existing survey lines, except where they have rehabilitated. Other temporary access tracks may be utilised where such use is likely to result in less environmental impact than other options. •Vegetation is removed only when absolutely necessary - avoided by weaving lines through vegetated areas. •Root stock, topsoil and seeds are left on line during line preparation. •Creek bank vegetation is left intact and detours located if dense. •All vehicles are thoroughly cleaned prior to entry into the survey area. 	<ul style="list-style-type: none"> •No mature trees are removed. •EMPs are selected from photo points where additional monitoring is deemed appropriate.

Santos

Performance Objective	Operational Controls	Measurement Criteria
	<ul style="list-style-type: none"> •No heavy line preparation machinery is used in wetlands areas. •Natural drainage channels are left clear at line crossings. 	
<u>Objective 4:</u> <ul style="list-style-type: none"> •Avoid disturbance to sites of sacred or cultural and heritage significance 	<ul style="list-style-type: none"> •Santos will obtain all necessary approvals and consents from CLC prior to commencement of line activities. •Santos will incorporate any sites identified by the Aboriginal Areas Protection Authority and the NT Heritage Council. •Santos and the Seismic Contractor will comply with approval conditions while undertaking all activities. •All line preparation personnel and crew supervisors will receive a project specific cultural heritage induction prior to commencing work. •All line preparation machinery operators are required to observe for cultural heritage sites that may have been missed during the Site Clearance process. •Known sites of sacred or cultural significance are identified, avoided and reported to a Cultural Heritage team member to ensure discoveries are managed in line with the relevant agreement and legislative requirements. •Any new sites identified during the survey operations will be reported to the Santos Cultural Heritage Team and avoided. 	<ul style="list-style-type: none"> •No line preparation activities commence before receiving CLC SSCC, NT Heritage Council sites, AAPA Sites and assessment issued by Santos Cultural Heritage team. •Compliance with the conditions of the Cultural Heritage assessment issued by the Cultural Heritage team, this will include details of the SSCC. •All line preparation personnel and crew supervisors have completed the project specific induction before commencing work. •No known sites are disturbed by the operations. •Santos / Seismic Contractor has a mechanism in place to report and respond to any new sites discovered during survey operations. •Any new sites identified during operations were reported and avoided.

Santos

Performance Objective	Operational Controls	Measurement Criteria
<u>Objective 5:</u> <ul style="list-style-type: none"> •Minimise disturbance to livestock, pastoral infrastructure and landholders 	<ul style="list-style-type: none"> •Relevant landowners and occupiers are notified prior to survey of preparation of camp sites, preparation of survey lines and undertaking of operations. •Relevant mineral and geothermal tenement holders shall be notified of survey of preparation of camp sites, preparation of survey lines and undertaking of operations. •Compliance with requirements of the Cattle Care and Organic Beef accreditation programmes or management as requested by the landholders, including full time monitoring by on field staff and inclusion in site inductions. •System is in place for logging landholder complaints to ensure that issues are addressed as appropriate. •Seismic sources are not to operate within the distance defined by Santos standards, of any pipeline, utility, installation or building. •Damage to station tracks is avoided. •All gates are left in the condition in which they were found (i.e. open / closed). •When necessary, all fences are restored to satisfaction of landowner / managers. •Inductions for all employees and contractors cover pastoral, conservation, legislation and infrastructure issues. 	<ul style="list-style-type: none"> •No reasonable concerns raised by stakeholders are left unresolved.
<u>Objective 6:</u> <ul style="list-style-type: none"> •Avoid the introduction or spread of exotic species and implement measures necessary 	<ul style="list-style-type: none"> •All vehicles, plant and equipment shall be cleaned and inspected prior to arrival at the project area. •A register of vehicle / equipment / machinery cleaning is kept. •Records of detection, monitoring or eradication of exotic weed or other pest or noxious species introduced by activities are. 	<ul style="list-style-type: none"> •A register of machinery / vehicle wash down or cleanliness prior to arrival at the project site is available. •Weeds were not introduced into, or spread through project area as a result of seismic operations.
<u>Objective 7:</u> <ul style="list-style-type: none"> •Minimise disturbance to 	<ul style="list-style-type: none"> •All access through watercourses are carefully assessed to determine the locations of least impact to channels and creek banks. 	<ul style="list-style-type: none"> •Camp sites and survey lines / traverses are located and

Santos

Performance Objective	Operational Controls	Measurement Criteria
<p>drainage patterns and avoid contamination of surface waters and shallow groundwater resources</p>	<ul style="list-style-type: none"> • Any remediation work should be undertaken immediately upon completion of all activities. • If any contamination from spillage of oils or fuel occurs during vehicular operations, immediate effective clean-up procedures must be employed. • Storage and handling of hazardous substances shall be in accordance with HSHS08 – Chemical Management. • Supervisors shall ensure that all personnel are familiar with spill prevention measures including refuelling techniques (e.g. use of spill mats) and chemical storage and handling requirements. • Refuelling will not occur within 1km from major watercourses or sensitive ecological environments (wetlands). • Fuel and oil spills are reported, treated and or remediated and the ground ripped. • If any contamination from spillage of oils or fuel occurs during vehicular operations, immediate effective clean-up procedures must be employed. • All chemical and fuel storage areas shall be bunded. • Safety Data Sheets shall be obtained upon purchase of chemicals and kept on-site for all chemicals stored and handled. • Chemical use will be minimised where practicable and the minimum practicable volume will be kept on site. • Appropriate spill response equipment available on site. • Protective clothing, appropriate to the materials in use, will be provided. • Fuels, lubricants and chemicals shall be stored and handled within containment facilities away from the vicinity of watercourses and water storage areas. • Absorbent and containment material (e.g. absorbent matting) will be available where hazardous materials are used and stored and personnel trained in correct use. • Fuel storage contained within double skin tanker with safety valves. 	<p>constructed to avoid diversion of water flows.</p> <ul style="list-style-type: none"> • There is no unnecessary interference with natural drainage features. • Fuel storage contained within double skin tanker with safety valves. • Appropriate containment bunding for site drum storage protection is implemented. • No spills occur outside designated refuelling/servicing areas. • Refuelling occurs at least 1km from watercourses or sensitive ecological environments (wetlands). • Appropriate spill response equipment is available on site. • Spills or leaks are cleaned up.

Santos

Performance Objective	Operational Controls	Measurement Criteria
<u>Objective 8:</u> •Optimise (in order of most to least preferable) waste avoidance, reduction, reuse, recycling, treatment and disposal	<ul style="list-style-type: none"> •All empty drums will be stored on impervious areas with their closures in place, or transported immediately off-site. •All generated waste (including consumable rubbish such as lunch wrappers) shall be returned to the camp and placed in the appropriately waste receptacle. •All loads of rubbish are covered during transport. •Covered bins are provided for the collection and storage of wastes. •No incineration or open burning of waste materials shall occur on-site. •No liquid wastes will be released accidentally or routinely discharged to surface waters. •Refuse containers/bags will be available with each crew. •Waste shall be removed from the camp by an appropriately licensed contractor and disposed at an approved facility. Records shall be kept of disposal of waste oils and fluids and hazardous wastes. 	<ul style="list-style-type: none"> •Wastes are stored and transported to an approved waste disposal facility. •Waste register documents waste type, transportation contractor and disposal facility. •Waste register and transfer receipts to be provided to DME on completion of operations.
<u>Objective 9:</u> •Remediate and rehabilitate operational areas as necessary	<ul style="list-style-type: none"> •All access will be clearly identified and all vehicles and machinery shall remain within the designated access ways and surveyed seismic lines. •Proper use of access tracks involves travel at safe speeds, utilisation of designated parking areas, sensible use during wet weather, gates being left as found. •During rehabilitation operations, work will cease if weather conditions inhibit access. •All earthworks shall be confined to the survey lines, access tracks and camp sites. •All marking, flagging and signage not required will be removed. •If contamination from spillage of oils or fuel occurs during vehicular operations, immediate effective clean-up procedures will be employed. •All gates are left in the condition in which they were found (i.e. open / closed). •Fences will be reinstated after all access is completed. •All windrows are removed either during or on completion of work. 	<ul style="list-style-type: none"> •Refer to assessment criteria for Objectives 2, 3, 7 and 8.

Santos

Performance Objective	Operational Controls	Measurement Criteria
	<ul style="list-style-type: none"> • Camp site areas are ripped, if necessary, on completion of work. • Operations are shut down during wet weather or flooding and only restarted once potential for extensive damage has passed. Unavoidable damage is reinstated on completion of work. • Unavoidable compaction in areas other than those susceptible to erosion, will be ripped on completion of work. • No heavy machinery is used in wetlands areas for rehabilitation. • Public access along survey lines will be discouraged by the use of signs at public roads. • 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. • Photopoint monitoring incorporates post-survey re-visits with emphasis on sensitive areas and areas subject to erosion such that additional restoration work can be implemented if required. 	
<u>Objective 10:</u> • To generate no fires from the Seismic Operations.	<ul style="list-style-type: none"> • Include Fire Season education as part of the induction. • Appropriate fire prevention procedures in place. • Appropriate fire fighting gear available to the crew. • All vehicles will be equipped with portable fire extinguishers. • Machinery and vehicles should be parked in areas of low fire risk and be free of any combustible material, for example in the case of dry grass build up. • Open fires, including open barbecues, billy fires, and brush burning, are banned on the Project. 	<ul style="list-style-type: none"> • No fires were started due to operations. • All personnel were informed on the fire danger season and associated restrictions.

Santos

4 CONSULTATION

Santos is committed to upholding its long-held reputation as a trusted Australian energy company. Santos seeks to establish and maintain enduring and mutually beneficial relationships with the communities of which it is a part; ensuring that Santos' activities generate positive economic and social benefits for and in partnership with these communities.

4.1 Stakeholder Identification

Stakeholder identification was conducted early in the project. Stakeholders include:

- Community
- Landholders
- Traditional Owners and Aboriginal Peoples
- Representatives of Local Government
- Northern Territory Government departments
- Media
- Other key non-commercial external stakeholders (e.g. NGOs and industry bodies)
- Industrial Relations stakeholders
- Other commercial external stakeholders
- Internal stakeholders

4.2 Stakeholder Consultation

Santos has undertaken consultation to ensure that the key stakeholders are aware of the components of the exploration program. The purpose of the consultation has been to:

- Educate and inform key stakeholders of the elements of the Southern Amadeus Basin Exploration Program and possible future production
- Build and maintain stakeholder confidence through key relationships
- Gain trust and acceptance in the local communities as a responsible member of society
- Listen to and address concerns or queries
- Educate the community, landholders, business operators and Traditional Owners on why and how Santos operates

The key component of the engagement program has been face-to-face briefing sessions with key individuals and groups with timely feedback on issues and concerns. Santos also participated in the information roadshow conducted by APPEA and the Department of Mines and Energy throughout the Northern Territory.

Santos will have 2 field based members based in Eldunda and Alice Springs on back to back rotation. They will be the primary point of contact for all landholders and community members during the project planning and execution phases.

Santos

5 REFERENCES

- BoM (2014). Climate Data Online. Accessed in June 2014 at
http://www.bom.gov.au/climate/averages/tables/cw_015590.shtml
- Department of Environment (DoE) (2016). *Protected Matters Search Tool*. Available from
<https://www.environment.gov.au/epbc/protected-matters-search-tool>. Accessed 14 January 2016.
- Department of Land Resource Management (DLRM) (2014a). *NR Maps NT*. Available from
<http://www.ntlis.nt.gov.au/imfPublic/imf.jsp?site=nreta>. Accessed 25 June 2014.
- Department of Land Resource Management (DLRM) (2014b). *Weeds in the NT*. Available from
<http://lrm.nt.gov.au/weeds2/ntweeds/significance#.UUIRRb9AXA4>. Accessed 25 June 2014.
- Department of Lands, Planning and the Environment (DLPE) (2014). *NT Heritage Register*. Available from <http://www.dlp.nt.gov.au/heritage/nt-heritage-register>. Accessed 25 June 2014.
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2014a). *National Heritage List*. Available from
<http://www.environment.gov.au/heritage/places/national/index.html>. Accessed in 27 June 2014.
- Fatchen, T.J. and Woodburn, J.A., (2000). Criteria for the abandonment of seismic lines and wellsites in the Cooper Basin. Stage 4 — Derivation of criteria. Fatchen Environmental Pty Ltd for the Office of Minerals and Energy Resources. *South Australia. Department of Primary Industries and Resources. Open file envelope*, DME-97-02.
- Santos (2011a). *South Australia Cooper Basin & Arid Regions: Statement of Performance objectives: Geophysical Operations*. Santos Ltd.
- Santos (2011b). *South Australia Cooper Basin & Arid Regions: Environmental Impact Report: Geophysical Operations*. Santos Ltd.
- Stoklosa R. (1999). *Practical Application of Environmental Risk Management – Gorgon LNG Project Case Study*. The APPEA Journal, 39 (1), 606-621.
- Wiltshire. D. and Schmidt, M., Fourth Edition (2003). *Field Guide to the Common Plants of the Cooper Basin (South Australia and Queensland)*. Santos Ltd., Adelaide, South Australia.