Our Ref: MER F2014/001129
9066

Government of South Australia
Department of State Development

17th December 2014

**Environmental Impact Classification - Pursuant to Section 98 of the *Petroleum and Geothermal Energy Act 2000* – Strike Energy Limited, Multi-well Exploration and Appraisal Production Testing from Deep Coals in PEL 96, Cooper Basin Statement of Environmental Objectives (SEO), December 2014**

Pursuant to section 98 of the *Petroleum and Geothermal Energy Act 2000* (the Act) the Minister must classify the regulated activities covered by a prepared Environmental Impact Report (EIR) as either of low, medium or high environmental impact.

The classification must be made on the basis of:

- The prepared EIR;
- Criteria established for classifying the level of environmental impact of regulated activities, a copy of which is found on the Department of State Development Energy (DSD) Petroleum web page: http://petroleum.dmitre.sa.gov.au/environment/register/seo,_eir_and_esa_reports/significance_assessment_criteria; and
- Comment received from relevant Government departments in accordance with established administrative arrangements between these departments and DSD.

This document summarises the classification made by DSD on the *Strike Energy Limited, Multi-well Exploration and Appraisal Production Testing from Deep Coals in PEL 96, Cooper Basin SEO, December 2014*. This classification is based on information provided in the EIR prepared for Strike Energy Limited by JBS&G.

## SUMMARY OF CLASSIFICATION

1) From an analysis of the environmental significance of the events and potential impacts associated with the proposed activities against the classification criteria referred to above (assessment provided as Attachment 1), these regulated activities have been classified as **low environmental impact**.
2) The large majority of events associated with the *Strike Energy Limited, Multi-well Exploration and Appraisal Production Testing from Deep Coals in PEL 96, Cooper Basin SEO, December 2014* were assessed to be of low environmental significance. This is due to the fact that appropriate management measures will be implemented by Strike Energy Limited to avoid or mitigate any potential environmental consequences.
3) For a low environmental impact classification, DSD is required to consult on the determined level of environmental impact with the Department of Environment, Water and Natural Resources (DEWNR) and the Environment Protection Authority (EPA) in accordance with relevant administrative arrangement's dated 11 November 2005 and 25 June 2012 respectively.

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SOUTH AUSTRALIA

4) Comments received from DEWNR and EPA on 31st of October and 3rd of November 2014 respectively agreed with the low environmental impact classification.

Pursuant to delegated powers, I hereby classify this regulated activity as **low environmental impact.**

BARRY GOLDSTEIN
**Executive Director**
**Energy Resources Division**
**Department of State Development**
**Delegate of the Minister for Mineral Resources and Energy**

**ACTIVITY:** Environmental Significance Assessment

**PROJECT:** Multi-well Exploration and Appraisal Production Testing from Deep Coals in PEL 96, Cooper Basin

**ABBREVIATIONS: H = High certainty; M = Medium certainty; L = Low certainty**

| | | | | PREDICTABILITY | | | | | | MANAGEABILITY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REF | TYPE OF IMPACT | EVENT(S) | POTENTIAL CONSEQUENCES | SIZE | SCOPE | DURATION | FREQUENCY | STAKEHOLDERS | SIGNIFICANCE | AVOIDANCE | PROBABILITY | DURATION | SIZE AND SCOPE | CUMULATIVE EFFECTS | STAKEHOLDERS | SIGNIFICANCE | SUPPORTING INFORMATION & COMMENTS | Environmental significance |
| | **Natural Environment Impacts** | | | | | | | | | | | | | | | | | |
| 4.2, 4.2.1, 6.2 | ***Soil Impacts*** | | | | | | | | | | | | | | | | PEL 96 lies within the Simpson Strzelecki Dunefields bio-geographical region (or bioregion) and the Strzelecki Desert subregion5, which contain extensive dunefields of parallel aeolian (i.e. wind-formed) dunes. The area of PEL 96 where the wells are located is characterised by the dunefields of the Tingana land system6. This land system is characterised by long parallel sandridges of red, yellow or white aeolian sands, with semi-mobile crests, sandy and clayey interdunes and numerous claypans and internal soakages (Marree Soil Conservation Board 2004). In the west of PEL 96, the Tingana land system transitions into the Collina and Blanche land systems. The Collina land system consists of a highly eroded and saline dunefield of truncated parabolic dunes adjacent and north of the Lake Callabonna, Blanche, Gregory complex. Dunes are predominantly vegetated with nitre bush, with broad saline flats and small plains and many small saline depressions. The Blanche land system consists of salt lake country, often with pale dunes on the lake margins. The Klebb and Le Chiffre well sites are located in interdune corridors within extensive parallel dunefields. Soils at the sites are sandy clay loam. Occasional sandy areas are present in the interdune corridors, particularly to the north of the Klebb-1 location where the surface becomes sandy and uneven. Deeper sands are present on the adjacent dunes. | |
| 3.2, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Soil disturbance (e.g.. Erosion, disturbance) | H | H | H | H | H | 1 | No | High | Long | Confined | | | 3 | Earthworks and site construction activities have the potential for localised impacts to soil through inversion, compaction or increased erosion. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practicable. Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). Stabilise and control areas where there is potential for (or signs of) soil erosion or sedimentation occurring. All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notification / management of works and site issues including livestock management. Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requirements (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. | **LOW** |
| 6.1.2, Table 8 | | Loss of well integrity | Contamination of soil | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | A loss of well integrity could result in the leakage of reservoir fluids or hydrocarbons to aquifers or cross-flow between aquifers that are normally isolated. The risk is reduced to as low as possible by well design and construc and managed through operational monitoring and maintenance. Aquifers isolated behind casing string(s), cemented to surface. New casing and wellhead installed. Casing and wellhead designed to meet pressure, temperature, operational stresses and loads. Cement bond logs run to confirm quality of cement. Where there is evidence of insufficient isolation, remedial action is conducted. Well control equipment used during workover activities. Installation of tubing string for production testing. Ongoing well integrity monitoring. Emergency response plan in place and drills conducted. **Note: Well integrity is managed under Drilling SEO (Santos 2009).** | **N/A** |
| 6.2, Table 8 | | Leak or spill of produced water (e.g. from lined ponds, pumps or flowlines) | Salinisation or contamination of soil | H | H | M | H | H | 2 | No | Low | | | | | 1 | Spills or leaks of produced water have the potential to result in localised salinisation or contamination of soil and unconfined shallow groundwater. Produced water is not expected to have high salinity (it is expected to be in the mid-brackish range i.e. in the order of 5,000 mg/L). Chemical dosing requirements (e.g. biocides, scale inhibitors) are likely to be low and where possible, biodegradable or UV degradable chemicals will be used. Significant concentrations of contaminants from the reservoir (e.g. hydrocarbons, metals) are not expected to be present. Unconfined groundwater (which is expected to be at a depth of 5-10 m or more at the sites) is expected to be saline (in the order of 10,000 mg/L). There is no local use of unconfined groundwater and no sensitive receptors or sensitive land uses near the sites. Ponds appropriately lined (e.g. with UV stabilised HDPE). Quality control on pond construction and pond liner installation. Maximum pond fill level not exceeded. Ponds with above-ground walls / bunds to prevent surface runoff into ponds. Pond operation monitored (e.g. pond wall integrity) and repair undertaken if required. Flowlines rated and pressure tested to appropriate pressure. Evaporator operation monitored (if they are used) and measures implemented to minimise potential impacts (e.g. moving or shutting down problem evaporator units on windy days). Routine inspections of flowlines and operational areas. Spills / leaks cleaned up and remediated where appropriate. Additional fencing installed where necessary to prevent st access. Note: Water table is expected to be predominantly saline, with no use of shallow unconfined groundwater. This further mitigates the level of risk. | **LOW** |
| 6.2, Table 8 | | 'Freeform' water disposal | Salinisation or contamination of soil | H | H | H | H | H | 1 | No | Low | | | | | 1 | Salinity of produced water is expected to be lower than the salinity of the unconfined groundwater (and within the range of salinities that can be used for irrigation of grasses and some crops) and significant concentrations of contaminants are not expected to be present. Produced water expected to be fresh to brackish (i.e. not high salinity). Water quality analysis undertaken to assess suitability for freeform disposal. Disposal to freeform not undertaken if water quality is unsuitable and likely to result in relevant soil or groundwater criteria being exceeded (e.g. EPA, ANZECC or NEPM (site contamination) criteria). Site selected to minimise environmental impact ( select enclosed interdune swale with minimal perennial vegetation, avoid significant vegetation and cultural heritage sites). Use of chemicals (e.g. biocides, scale inhibitors) minimised and biodegradable or UV degradable chemicals used where available. Methods such as batch dosing and diversion of dosed water to lined ponds implemented where necessary (e.g. if freeform disposal is being used). | **LOW** |
| 6.6, Table 8 | | Explosion or fire | Contamination of soil | M | H | H | H | H | 2 | No | Low | | | | | 1 | A fire or explosion can pose a danger to personnel, contractors and possibly the public. The activities will be carried out at established well sites which are remote from public roads and where public access is limited. All production testing equipment designed and constructed in accordance with relevant standards (e.g. AS3000, AS1940, AS 2885). Safety, testing, maintenance and inspection procedures are implemented. Establishment of appropriate emergency / spill response procedures for explosion or fire. Appropriate fire fighting equipment at production test sites. Erection of signage and, where required, fencing to delineate restricted / hazardous areas. Safe work permits be obtained to ensure only individuals with proper clearance can conduct works. Smoking only in designated areas located away from equipment or activity. Petrol vehicles to be excluded from restricted areas. Appropriate firebreaks are maintained. | **LOW** |
| 6.2, Table 8 | | Spill or leaks associated with fuel or chemical storage and handling | Contamination of soil | H | H | H | H | H | 1 | No | Med | Short | Confined | | | 2 | Improper storage and handling of fuel or chemicals has the potential to result in localised contamination of soil and shallow groundwater. Implementation of appropriate chemical and fuel storage and handling procedures, in accordance with Safety Data Sheets and relevant standards and guidelines, including AS 1940, EPA guidelines 080/12 Bunding and Spill Management and the Australian Dangerous Goods Code (ADG). Appropriate drip capture / spill capture methods implemented in refuelling areas (e.g. use of drip trays or liners). Emergency/spill response procedures in place and appropriate spill response equipment is available on site. Personnel have received training in the use of spill response equipment. Spills or leaks are immediately reported and clean-up actions initiated. Contaminated material removed off-site for appropriate treatment or disposal. Fencing of contaminated areas if threat is posed to stock or wildlife. | **LOW** |
| 6.2, Table 8 | | Storage, handling and disposal of waste | Localised contamination of soil | H | H | H | H | H | 1 | No | Low | | | | | 1 | Inappropriately managed waste has the potential to result in localised disturbance or contamination of soil and shallow groundwater. Waste generation minimised (e.g. by compliance with EPA's Waste Hierarchy model (avoid, reduce, reuse, recycle, recover, treat, dispose)). High standards of 'housekeeping' implemented. Waste removed off-site and disposed of at an EPA licensed waste handling facility. Secure systems used for storage and transport of waste (e.g. covered bins in designated area for waste collection and storage prior to transport). Hazardous wastes handled in accordance with relevant legislation and standards. Licensed contractors used for waste transport. All wastewater is disposed in accordance with the South Australian Public Health (Wastewater) Regulations 2013 or to the satisfaction of the Department of Health. | **LOW** |
| 4.3, 4.3.1, 5.2, | ***Groundwater Impacts & Surface Water Impacts*** | | | | | | | | | | | | | | | | The dominant surface water feature in the region is the Cooper Creek (located approximately 150 km to the north of PEL 96), which originates in catchments in south-west Queensland and drains into the Lake Eyre Basin. Strzelecki Creek is an overflow of the Cooper Creek and runs off the main channel just west of the South Australian border, flowing southward into the Lake Frome catchment. Strzelecki Creek is part of an ephemeral wetland system which extends 200 km south of Cooper Creek, to Lake Blanche, an ephemeral freshwater lake that becomes saline as it dries out. Lake Blanche forms part of a string of interconnected salt lakes, including Lake Gregory in the north-west and Lake Callabonna in the south-east. The Klebb site is located approximately 3 km to the west of Strzelecki Creek and the Le Chiffre site is approximately 5 km to the east of the creek. The sites a separated from the Strzelecki Creek floodplain by dunes. There is no defined drainage system at the sites. They are located in interdune corridors with only internal drainage. At the Le Chiffre site, localised internal drainage created some minor bare run-on areas. Regional hydrogeology is dominated by the presence of the Great Artesian Basin (GAB). The GAB is one of the largest multi-layer aquifer systems in the world, and it underlies one fifth of Australia including parts of Queensland, New South Wales, South Australia and the Northern Territory (CSIRO, 2012c). The sediments of the Lake Eyre Basin consist of Tertiary and Quaternary alluvial sands and gravel, and often contain beds of lignite and clay. The sand units can host useful local aquifers that are often exploited for stock water. GAB-fed discharge springs are present in the region in the spring supergroup of Lake Frome, which occurs to the south and south-west of the sites, extending from Lake Blanche to Lake Frome. However, almost all of these springs are located remote from the project site. The closest spring (with 10 related minor vents) is mapped at 50 km from the site on the north-western margin of Lake Blanche. | |
| 3.2, 6.3, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Disturbance to natural drainage patterns | H | H | H | H | H | 1 | No | Med | Med | Confined | | | 3 | Earthworks have the potential to alter natural drainage patterns or result in increased sedimentation of surface water features. This can potentially affect native vegetation and fauna as discussed in Section 6.4. Due to the si location within an extensive dunefield, where surface drainage is confined to individual interdune swales, the potential for impact is relatively low. Very minor and localised impacts to drainage will occur at the sites, which will ultimately be rehabilitated to restore natural surface profiles and original drainage patterns. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practicable. Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). Significant disturbance to drainage patterns avoided (e.g. road construction at (or not significantly above)) natural surface, surface water flows maintained, overland flows diverted around lease or ponds where required). Stabilise and control areas where there is potential for (or signs of) soil erosion or sedimentation occurring. All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Areas of sensitivity (e.g. flora with significant conservation value, cultural heritage exclusion areas) flagged and / or fenced off where necessary to prevent disturbance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notification / management of works and site issues including livestock management. (Note: Area is currently not stocked). Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requirements (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. | **LOW** |
| | | | Sedimentation of surface waters | H | H | H | H | H | 1 | No | Low | | | | | 1 | | **LOW** |
| Table 8 | | Water extraction / drawdown in Patchawarra coals | Drawdown of overlying GAB aquifers | H | M | H | H | M | 2 | No | Low | | | | | 1 | A hydrogeological assessment has been undertaken to assess the potential impacts of the multi-well production testing program on GAB aquifers (Middlemis 2014). Water production rates fall within the allocation under the WAP for petroleum co-produced water (60 ML/d industry-wide). Closest GAB springs 50 km from site. No GAB wells or GAB users in close proximity (closest is 40 km distant). Hydrogeological assessment using very conservative assumptions indicates expected extraction rates are well inside sustainable limits set by WAP, based on allowable drawdown at spring exclusion zones and Southwest Spring Zone boundary. It is not likely to have a significant impact on a water resource in the context of the EPBC Act (DoE 2013a), as it will not result in a change in hydrology or water quality that is of sufficient scale or intensity to reduce the current or future utility for th party users. Ongoing monitoring and data collection to investigate potential impacts of extraction. | **LOW** |
| 6.1.2, Table 8 | | Leakage of desorbed gas (following pressure reduction in reservoir) to overlying aquifers | Contamination of aquifers | M | M | H | H | M | 2 | No | Low | | | | | 1 | A loss of well integrity could result in the leakage of reservoir fluids or hydrocarbons to aquifers or cross-flow between aquifers that are normally isolated. The risk is reduced to as low as possible by well design and construc and managed through operational monitoring and maintenance. Leakage of desorbed gas from the target coals via pathways other than the well bore is considered to be a very low risk for this production test. Patchawarra coals are separated from overlying GAB aquifers by over 400 m of varying lithologies, including low permeability fine grained sandstones, mudstones and siltstones. Seismic information has not detected large scale faults in the central Weena Trough that connect the GAB to the Permian section. Some smaller faults are evident, which Strike believes are confined to the Permian. Fracture stimulation undertaken is small-scale and designed to remain in the Patchawarra Formation (i.e. no fracture propagation into overlying aquifers). Once production testing commences, the pressure gradient underground will result in fluids moving towards the well rather than away from t well bore. No GAB wells or GAB users in close proximity (closest is 40 km distant). Wells cased and cemented with ongoing integrity monitoring loss of well integrity could result in the leakage of reservoir fluids or hydrocarbo to aquifers or cross-flow between aquifers that are normally isolated. | **LOW** |
| 6.1.1, Table 8 | | Loss of well integrity | Contamination or overpressurisation of aquifers (resulting from cross flow) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | A loss of well integrity could result in the leakage of reservoir fluids or hydrocarbons to aquifers or cross-flow between aquifers that are normally isolated. The risk is reduced to as low as possible by well design and construc and managed through operational monitoring and maintenance. Aquifers isolated behind casing string(s), cemented to surface. New casing and wellhead installed. Casing and wellhead designed to meet pressure, temperature, operational stresses and loads. Cement bond logs run to confirm quality of cement. Where there is evidence of insufficient isolation, remedial action is conducted. Well control equipment used during workover activities. Installation of tubing string for production testing. Ongoing well integrity monitoring. Emergency response plan in place and drills conducted. **Note: Well integrity is managed under Drilling SEO (Santos 2009)** | **N/A** |
| 6.1.2, Table 8 | | | Contamination of surface and groundwater | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | | **N/A** |
| 6.1.3, Table 8 | | Water supply / use | Drawdown of artesian and sub-artesian aquifers | H | H | H | H | H | 1 | Yes | | | | | | 1 | Limited volumes of water will need to be supplied for the production testing. The water bores at Klebb and Le Chiffre would be preferentially used if required. If other bores need to be utilised, they would be accessed in consultation with bore owners. Water extraction in compliance with licensing and water allocations under FNPWA Water Allocation Plan where applicable. Water supply wells reviewed to ensure that their use does not impact adversely on existing users of groundwater or groundwater dependent ecosystems. Options for alternative water supplies investigated / used where possible (e.g. reuse of produced water). Monitoring of water extraction volumes. | **LOW** |
| 6.2, Table 8 | | Leak or spill of produced water (e.g. from lined ponds, pumps or flowlines) | Salinisation or contamination of groundwater and surface water | H | H | M | H | H | 2 | No | Low | | | | | 1 | Spills or leaks of produced water have the potential to result in localised salinisation or contamination of soil and unconfined shallow groundwater. Produced water is not expected to have high salinity (it is expected to be in the mid-brackish range i.e. in the order of 5,000 mg/L). Chemical dosing requirements (e.g. biocides, scale inhibitors) are likely to be low and where possible, biodegradable or UV degradable chemicals will be used. Significant concentrations of contaminants from the reservoir (e.g. hydrocarbons, metals) are not expected to be present. Unconfined groundwater (which is expected to be at a depth of 5-10 m or more at the sites) is expected to be saline (in the order of 10,000 mg/L). There is no local use of unconfined groundwater and no sensitive receptors or sensitive land uses near the sites. Ponds appropriately lined (e.g. with UV stabilised HDPE). Quality control on pond construction and pond liner installation. Maximum pond fill level not exceeded. Ponds with above-ground walls / bunds to prevent surface runoff into ponds. Pond operation monitored (e.g. pond wall integrity) and repair undertaken if required. Flowlines rated and pressure tested to appropriate pressure. Evaporator operation monitored (if they are used) and measures implemented to minimise potential impacts (e.g. moving or shutting down problem evaporator units on windy days). Routine inspections of flowlines and operational areas. Spills / leaks cleaned up and remediated where appropriate. Additional fencing installed where necessary to prevent st access. Note: Water table is expected to be predominantly saline, with no use of shallow unconfined groundwater. This further mitigates the level of risk. | **LOW** |

| | | | | ABBREVIATIONS: H = High certainty; M = Medium certainty; L = Low certainty | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PREDICTABILITY | | | | | | MANAGEABILITY | | | | | | | |
| REF | TYPE OF IMPACT | EVENT(S) | POTENTIAL CONSEQUENCES | SIZE | SCOPE | DURATION | FREQUENCY | STAKEHOLDERS | SIGNIFICANCE | AVOIDANCE | PROBABILITY | DURATION | SIZE AND SCOPE | CUMULATIVE EFFECTS | STAKEHOLDERS | SIGNIFICANCE | SUPPORTING INFORMATION & COMMENTS | Environmental significance |
| 6.3, Table 8 | | 'Freeform' water disposal | Salinisation or contamination of groundwater | H | H | H | H | H | 1 | No | Low | | | | | 1 | Salinity of produced water is expected to be lower than the salinity of the unconfined groundwater (and within the range of salinities that can be used for irrigation of grasses and some crops) and significant concentrations of contaminants are not expected to be present. Produced water expected to be fresh to brackish (i.e. not high salinity). Water quality analysis undertaken to assess suitability for freeform disposal. Disposal to freeform not undertaken if water quality is unsuitable and likely to result in relevant soil or groundwater criteria being exceeded (e.g. EPA, ANZECC or NEPM (site contamination) criteria). Site selected to minimise environmental impact ( select enclosed interdune swale with minimal perennial vegetation, avoid significant vegetation and cultural heritage sites). Use of chemicals (e.g. biocides, scale inhibitors) minimised and biodegradable or UV degradable chemicals will be used. Significant concentrations of contaminants from the reservoir (e.g. hydrocarbons, metals) are not expected to be present. Unconfined groundwater (which is expected to be at a depth of 5-10 m or more at the sites) is expected to be saline (in the order of 10,000 mg/L). There is no local use of unconfined groundwater and no sensitive receptors or sensitive land uses near the sites. Ponds appropriately lined (e.g. with UV stabilised HDPE). Quality control on pond construction and pond liner installation. Maximum pond fill level not exceeded. Ponds with above-ground walls / bunds to prevent surface runoff into ponds. Pond operation monitored (e.g. pond wall integrity) and repair undertaken if required. Flowlines rated and pressure tested to appropriate pressure. Evaporator operation monitored (if they are used) and measures implemented to minimise potential impacts (e.g. moving or shutting down problem evaporator units on windy days). Routine inspections of flowlines and operational areas. Minimise use of chemicals (e.g. biocides, scale inhibitors). Spills / leaks cleaned up and remediated where appropriate. Additional fencing installed where necessary to prevent stock access. Note: Water table is expected to be predominantly saline, with no use of shallow unconfined groundwater. This further mitigates the level of risk. | **LOW** |
| 6.6, Table 8 | | Explosion or fire | Contamination of surface and groundwater | M | H | H | H | H | 2 | No | Low | | | | | 1 | A fire or explosion can pose a danger to personnel, contractors and possibly the public. The activities will be carried out at established well sites which are remote from public roads and where public access is limited. All production testing equipment designed and constructed in accordance with relevant standards (e.g. AS3000, AS1940, AS 2885). Safety, testing, maintenance and inspection procedures are implemented. Establishment of appropriate emergency / spill response procedures for explosion or fire. Appropriate fire fighting equipment at production test sites. Erection of signage and, where required, fencing to delineate restricted / hazardous areas. Safe work permits be obtained to ensure only individuals with proper clearance can conduct works. Smoking only in designated areas located away from equipment or activity. Petrol vehicles to be excluded from restricted areas. Appropriate firebreaks are maintained. | **LOW** |
| 6.2, 6.3, Table 8 | | Spill or leaks associated with fuel or chemical storage and handling | Contamination of surface and groundwater | H | H | H | H | H | 1 | No | Med | Short | Confined | | | 2 | Improper storage and handling of fuel or chemicals has the potential to result in localised contamination of soil and shallow groundwater. The principal risk to surface water results from the potential transport off-site of material from spills or leaks. Due to the confined nature of the surface drainage within the dunefield (and the absence of drainage lines or significant surface water features), any impacts would be relatively minor and localised even i material was transported off the immediate spill site. Implementation of appropriate chemical and fuel storage and handling procedures, in accordance with Safety Data Sheets and relevant standards and guidelines, including AS 1940, EPA guidelines 080/12 Bunding and Spill Management and the Australian Dangerous Goods Code (ADG). Appropriate drip capture / spill capture methods implemented in refuelling areas (e.g. use of drip trays or liners). Emergency/spill response procedures in place and appropriate spill response equipment is available on site. Personnel have received training in the use of spill response equipment. Spills or leaks are immediately reported and clean-up actions initiated. Contaminated material removed off-site for appropriate treatment or disposal. Fencing of contaminated areas if threat is posed to stock or wildlife. | **LOW** |
| 6.2, Table 8 | | Storage, handling and disposal of waste | Localised of surface water and groundwater | H | H | H | H | H | 1 | No | Low | | | | | 1 | Inappropriately managed waste has the potential to result in localised disturbance or contamination of soil and shallow groundwater. Waste generation minimised (e.g. by compliance with EPA's Waste Hierarchy model (avoid, reduce, reuse, recycle, recover, treat, dispose)). High standards of 'housekeeping' implemented. Waste removed off-site and disposed of at an EPA licensed waste handling facility. Secure systems used for storage and transport of waste (e.g. covered bins in designated area for waste collection and storage prior to transport). Hazardous wastes handled in accordance with relevant legislation and standards. Licensed contractors used for waste transport. All wastewater is disposed in accordance with the South Australian Public Health (Wastewater) Regulations 2013 or to the satisfaction of the Department of Health. | **LOW** |
| 4.4.1, 4.4.3 | ***Vegetation Impacts*** | | | | | | | | | | | | | | | | The Klebb site is vegetated with an open grassland of Neverfail (Eragrostis setifolia) and Bottlewashers (Enneapogon avenaceus) with occasional shrubs such as Umbrella Wattle (Acacia oswaldii), Sida spp. and a sparse understorey of Copperburrs (Sclerolaena sp.), annual saltbushes, Nardoo (Marsilea drummondii) and herbs. As the interdune corridor becomes sandy to the north, vegetation becomes an open grassland of Sandhill Canegrass (Zygochloa paradoxa), Desert Cynanchum (Cynanchum floribundum), Neverfail (Eragrostis setifolia) and Bottlewashers (Enneapogon avenaceus) with a sparse understorey of herbs. The Le Chiffre site is vegetated with an open grassland of Neverfail (Eragrostis setifolia) and Bottlewashers (Enneapogon avenaceus) with occasional shrubs such as Sida spp. and a sparse understorey of Copperburrs (Sclerolaena sp.) and herbs. No plant species of conservation significance were recorded during site inspections of the Klebb and Le Chiffre sites, which were carried out in June 2013 and July 2014 by Roger Playfair (RMP Environmental) (RPS 2013, RPS 2014b). There are relatively few weeds recorded in the region and no weed species of particular significance were observed at the Klebb and Le Chiffre sites (or other nearby sites inspected) during site inspections. Two introduced plant species (Rosy Dock (Acetosa vesicaria) and Wild Turnip (Brassica tournefortii)) have been recorded at sites inspected in the region, including Klebb and Le Chiffre. Both of these species are widespread and naturalised and do not require any specific management measures. No threatened plants have been recorded in the immediate area of the Klebb and Le Chiffre sites and none were detected on the site inspection at the or any other sites inspected in this area of PEL 96 (which were all in similar interdune areas). If rare or threatened plant species were to occur at the well sites, they would be associated with very common and widespread habitat. | |
| 3.2, 6.4, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Damage to native vegetation and habitat | H | H | H | H | H | 1 | No | High | Long | Confined | | | 3 | Earthworks and site construction activities have the potential for localised impacts to native vegetation and wildlife habitats and to disturb or injure fauna. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practicable. Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). Significant disturbance to drainage patterns avoided (e.g. road construction at (or not significantly above) natural surface, surface water flows maintained, overland flows diverted around lease or ponds where required). Stabilise and control areas where there is potential for (or signs of) soil erosion or sedimentation occurring. All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Areas of sensitivity (e.g. flora with significant conservation value, cultural heritage exclusion areas) flagged and / or fenced off where necessary to prevent disturbance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notification / management of works and site issues including livestock management. (Note: Area is currently not stocked). Vehicle and equipment washdown undertaken before entering Cooper Basin or after operating in areas of known weed infestations. Excavations managed to minimise hazard to fauna (e.g. excavated areas left open for as little time as possible and regularly inspected for trapped fauna, fauna ladders (sticks etc.) used where appropriate to facilitate the movement of fauna out of excavations. Dust suppression measures implemented where required. Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requirements (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. | **LOW** |
| | | | Impact to threatened species | H | H | H | H | H | 1 | No | Low | | | | | 1 | | **LOW** |
| | | | Introduction and spread of weeds and pathogens | H | H | H | H | H | 1 | No | Low | | | | | 1 | | **LOW** |
| 6.1.1, Table 8 | | Water extraction / drawdown in Patchawarra coals | Impact on groundwater dependent ecosystems (e.g. if drawdown at GAB spring occurs) | H | H | H | H | M | 2 | No | Low | | | | | 1 | A hydrogeological assessment has been undertaken to assess the potential impacts of the multi-well production testing program on GAB aquifers (Middlemis 2014). Water production rates fall within the allocation under the WAP for petroleum co-produced water (60 ML/d industry-wide). Closest GAB springs 50 km from site. No GAB wells or GAB users in close proximity (closest is 40 km distant). Hydrogeological assessment using very conservative assumptions indicates expected extraction rates are well inside sustainable limits set by WAP, based on allowable drawdown at spring exclusion zones and Southwest Spring Zone boundary. It is not likely to have a significant impact on a water resource in the context of the EPBC Act (DoE 2013a), as it will not result in a change in hydrology or water quality that is of sufficient scale or intensity to reduce the current or future utility for th party users. Ongoing monitoring and data collection to investigate potential impacts of extraction. | **LOW** |
| 6.1.3, Table 8 | | Water supply / use | Impact on groundwater dependent ecosystems | H | H | H | H | H | 1 | Yes | | | | | | 1 | Limited volumes of water will need to be supplied for the production testing. The water bores at Klebb and Le Chiffre would be preferentially used if required. If other bores need to be utilised, they would be accessed in consultation with bore owners. Water extraction in compliance with licensing and water allocations under FNPWA Water Allocation Plan where applicable. Water supply wells reviewed to ensure that their use does not impact adversely on existing users of groundwater or groundwater dependent ecosystems. Options for alternative water supplies investigated / used where possible (e.g. reuse of produced water). Monitoring of water extraction volumes. | **LOW** |
| 6.2, Table 8 | | Leak or spill of produced water (e.g. from lined ponds, pumps or flowlines) | Death of adjacent vegetation | H | H | M | H | H | 2 | No | Low | | | | | 1 | Spills or leaks of produced water have the potential to result in localised salinisation or contamination of soil and unconfined shallow groundwater. Produced water is not expected to have high salinity (it is expected to be in the mid-brackish range i.e. in the order of 5,000 mg/L). Chemical dosing requirements (e.g. biocides, scale inhibitors) are likely to be low and where possible, biodegradable or UV degradable chemicals will be used. Significant concentrations of contaminants from the reservoir (e.g. hydrocarbons, metals) are not expected to be present. Unconfined groundwater (which is expected to be at a depth of 5-10 m or more at the sites) is expected to be saline (in the order of 10,000 mg/L). There is no local use of unconfined groundwater and no sensitive receptors or sensitive land uses near the sites. Ponds appropriately lined (e.g. with UV stabilised HDPE). Quality control on pond construction and pond liner installation. Maximum pond fill level not exceeded. Ponds with above-ground walls / bunds to prevent surface runoff into ponds. Pond operation monitored (e.g. pond wall integrity) and repair undertaken if required. Flowlines rated and pressure tested to appropriate pressure. Evaporator operation monitored (if they are used) and measures implemented to minimise potential impacts (e.g. moving or shutting down problem evaporator units on windy days). Routine inspections of flowlines and operational areas. Minimise use of chemicals (e.g. biocides, scale inhibitors). Spills / leaks cleaned up and remediated where appropriate. Additional fencing installed where necessary to prevent stock access. Note: Water table is expected to be predominantly saline, with no use of shallow unconfined groundwater. This further mitigates the level of risk. | **LOW** |
| 6.4, Table 8 | | 'Freeform' water disposal | Death of flooded and adjacent vegetation | H | H | H | H | H | 1 | No | High | Long | Confined | | | 3 | Salinity of produced water is expected to be lower than the salinity of the unconfined groundwater (and within the range of salinities that can be used for irrigation of grasses and some crops) and significant concentrations of contaminants are not expected to be present. Produced water expected to be fresh to brackish (i.e. not high salinity). Water quality analysis undertaken to assess suitability for freeform disposal. Disposal to freeform not undertaken if water quality is unsuitable and likely to result in relevant soil or groundwater criteria being exceeded (e.g. EPA, ANZECC or NEPM (site contamination) criteria). Site selected to minimise environmental impact ( | **LOW** |
| | | | Increase in grazing pressure (if stock can access water) resulting in inadvertent damage to vegetation and habitats | M | M | H | H | H | 2 | No | Low | | | | | 1 | select enclosed interdune swale with minimal perennial vegetation, avoid significant vegetation and cultural heritage sites). Use of chemicals (e.g. biocides, scale inhibitors) minimised and biodegradable or UV degradable chemicals used where available. Methods such as batch dosing and diversion of dosed water to lined ponds implemented where necessary (e.g. if freeform disposal is being used). Disposal of produced water could result in vegetation death from inundation, or long term alteration in vegetation due to changes in soil salinity. Given the predominantly ephemeral nature of the vegetation at the sites and the measures that will be implemented to minimise impacts to soil discussed in Section 6.2, significant impacts are not likely. Stock access to produced water precluded for production testing program. | **LOW** |
| 6.6, Table 8 | | Explosion or fire | Burning of vegetation and habitat | L | L | L | H | H | 4 | No | Low | | | | | 1 | The activities will be carried out at established well sites which are remote from public roads and where public access is limited. All production testing equipment designed and constructed in accordance with relevant standards (e.g. AS3000, AS1940, AS 2885). Safety, testing, maintenance and inspection procedures are implemented. Establishment of appropriate emergency / spill response procedures for explosion or fire. Appropriate fire fighting equipment at production test sites. Erection of signage and, where required, fencing to delineate restricted / hazardous areas. Safe work permits be obtained to ensure only individuals with proper clearance can conduct work Smoking only in designated areas located away from equipment or activity. Petrol vehicles to be excluded from restricted areas. Appropriate firebreaks are maintained. | **LOW** |
| 6.4, Table 8 | | Spill or leaks associated with fuel or chemical storage and handling | Damage to native vegetation and wildlife habitats | H | H | H | H | H | 1 | No | Low | | | | | 1 | Spills of fuel, chemicals or produced water have the potential to damage native vegetation. The likelihood of a spill affecting large areas of native vegetation away from the cleared well sites is very low. Implementation of appropriate chemical and fuel storage and handling procedures, in accordance with Safety Data Sheets and relevant standards and guidelines, including AS 1940, EPA guidelines 080/12 Bunding and Spill Management and the Australian Dangerous Goods Code (ADG). Appropriate drip capture / spill capture methods implemented in refuelling areas (e.g. use of drip trays or liners). Emergency/spill response procedures in place and appropriate spill response equipment is available on site. Personnel have received training in the use of spill response equipment. Spills or leaks are immediately reported and clean-up actions initiated. Fencing of contaminated areas if threat is posed to stock or wildlife. | **LOW** |
| 6.2, Table 8 | | Storage, handling and disposal of waste | Damage to native vegetation and wildlife habitats | H | H | H | H | H | 1 | No | Low | | | | | 1 | Inappropriately managed waste has the potential to result in localised disturbance or contamination of soil and shallow groundwater. Waste generation minimised (e.g. by compliance with EPA's Waste Hierarchy model (avoid, reduce, reuse, recycle, recover, treat, dispose)). High standards of 'housekeeping' implemented. Waste removed off-site and disposed of at an EPA licensed waste handling facility. Secure systems used for storage and transport of waste (e.g. covered bins in designated area for waste collection and storage prior to transport). Hazardous wastes handled in accordance with relevant legislation and standards. Licensed contractors used for waste transport. All wastewater is disposed in accordance with the South Australian Public Health (Wastewater) Regulations 2013 or to the satisfaction of the Department of Health. | **LOW** |
| 4.4.2 | ***Fauna Impacts*** | | | | | | | | | | | | | | | | Terrestrial and avian fauna species present in the Cooper Basin region include: Mammals: Small mammals such as Fat-tailed and Stripe-faced Dunnarts, Forrest's Mouse, Sandy Inland Mouse and House Mouse are commo The Dusky Hopping-mouse (nationally Vulnerable) is known to occur in the dunes of the Strzelecki Desert. Other mammals present include Little Broad-nosed Bat and Lesser Long-eared Bat. Larger mammal species include the Red Kangaroo, Dingo, and non-native species including cattle, camel, cat, rabbit and fox. Reptiles: Common reptiles include Fat-tailed Gecko, Eastern Brown Snake, Sand Goanna, Sandplain Ctenotus, Ghost Skink, Painted Dragon and Curl Snake. Amphibians: Ten frog species have been recorded in the Cooper Creek system including several species of burrowing frog (e.g. Sudell's Frog, Water-holding Frog) which may be relatively widespread and others (Desert Froglet, Green Tree Frog, Broad-palmed Frog) that would be restricted to areas near water (i.e. the Cooper Creek) except during flooding. Birds: Common bird species include Australian Magpie, Galah, Brown Falcon, Budgerigar, Black-faced Woodswallow and Little Corella. The region also supports a diverse assemblage of waterbirds, as discussed below. Strzelecki Creek has one of the highest densities and numbers of raptor species found anywhere in Australia (DEH 2002) and is one of Australia's most important raptor breeding areas (DEH 2009). The nationally vulnerable Dusky Hopping-mouse (Notomys fuscus) is know to occur in the region and has been recorded at numerous locations along the Strzelecki Track (see Table 5). This species inhabits sand dunes and areas of deep sand. It is considered to be widespread throughout dunefields of the southern and eastern Cooper Basin and beyond, but sparsely distributed. A number of State-listed bird species have been recorded in the area but they are not considered likely to be present at the sites or affected by site activities, given the habitat preference of many of the species (woodland or riparian habitats), their mobility, the relatively short term nature of the activities and the small proportion of available habitat that is involved (RPS 2013, 2014b). There are no known threatened ecological communities at or near the sites. The threatened ecological community listed under the EPBC Act as The community of native species dependent on natural discharg of groundwater from the Great Artesian Basin occurs in the broader area, on the margins of the Cooper / Eromanga Basins. The closest Great Artesian Basin springs (and the closest occurrence of this community) are approximately 50 km south-west of the sites, on the west side of Lake Blanche (Gotch 2013). | |
| 3.2, 6.4, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Damage to native vegetation and habitat | H | H | H | H | H | 1 | No | High | Long | Confined | | | 3 | Earthworks and site construction activities have the potential for localised impacts to native vegetation and wildlife habitats and to disturb or injure fauna. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practicable. Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). Significant disturbance to drainage patterns avoided (e.g. road construction at (or not significantly above) natural surface, surface water flows maintained, overland flows diverted around lease or ponds where required). Stabilise and control areas where there is potential for (or signs of) soil erosion or sedimentation occurring. All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Areas of sensitivity (e.g. flora with significant conservation value, cultural heritage exclusion areas) flagged and / or fenced off where necessary to prevent disturbance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notification / management of works and site issues including livestock management. (Note: Area is currently not stocked). Vehicle and equipment washdown undertaken before entering Cooper Basin or after operating in areas of known weed infestations. Excavations managed to minimise hazard to fauna (e.g. excavated areas left open for as little time as possible and regularly inspected for trapped fauna, fauna ladders (sticks etc.) used where appropriate to facilitate the movement of fauna out of excavations. Dust suppression measures implemented where required. Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requirements (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. Any direct impacts to fauna will be short term and localised, and given that the activities will impact an extremely small proportion of available habitat, are not likely to significantly impact any fauna populations. | **LOW** |
| | | | Impact to threatened species | H | H | H | H | H | 1 | No | Low | | | | | 1 | | **LOW** |
| | | | Disturbance to wildlife | H | H | H | M | H | 2 | No | High | Short | Confined | | | 2 | | **LOW** |

ABBREVIATIONS: H = High certainty; M = Medium certainty; L = Low certainty

| REF | TYPE OF IMPACT | EVENT(S) | POTENTIAL CONSEQUENCES | PREDICTABILITY | | | | | | MANAGEABILITY | | | | | | | SUPPORTING INFORMATION & COMMENTS | Environmental significance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | SIZE | SCOPE | DURATION | FREQUENCY | STAKEHOLDERS | SIGNIFICANCE | AVOIDANCE | PROBABILITY | DURATION | SIZE AND SCOPE | CUMULATIVE EFFECTS | STAKEHOLDERS | SIGNIFICANCE | | |
| 6.1.1, Table 8 | | Water extraction / drawdown in Patchawarra coals | Impact on groundwater dependent ecosystems (e.g. if drawdown at GAB spring occurs) | H | H | H | H | M | 2 | No | Low | | | | | 1 | A hydrogeological assessment has been undertaken to assess the potential impacts of the multi-well production testing program on GAB aquifers (Middlemis 2014). Water production rates fall within the allocation under the WAP for petroleum co-produced water (60 ML/d industry-wide). Closest GAB springs 50 km from site. No GAB wells or GAB users in close proximity (closest is 40 km distant). Hydrogeological assessment using very conservative assumptions indicates expected extraction rates are well inside sustainable limits set by WAP, based on allowable drawdown at spring exclusion zones and Southwest Spring Zone boundary. It is not likely to have a significant impact on a water resource in the context of the EPBC Act (DoE 2013a), as it will not result in a change in hydrology or water quality that is of sufficient scale or intensity to reduce the current or future utility for th party users. Ongoing monitoring and data collection to investigate potential impacts of extraction. | |
| 6.1.3, Table 8 | | Water supply / use | Impact on groundwater dependent ecosystems | H | H | H | H | H | 1 | Yes | | | | | | | Limited volumes of water will need to be supplied for the production testing. The water bores at Klebb and Le Chiffre would be preferentially used if required. If other bores need to be utilised, they would be accessed in consultation with bore owners. Water extraction in compliance with licensing and water allocations under FNPWA Water Allocation Plan where applicable. Water supply wells reviewed to ensure that their use does not impact adversely on existing users of groundwater or groundwater dependent ecosystems. Options for alternative water supplies investigated / used where possible (e.g. reuse of produced water). Monitoring of water extraction volumes. | **LOW** |
| 6.2, Table 8 | | Leak or spill of produced water (e.g. from lined ponds, pumps or flowlines) | Access to contaminants by wildlife | H | H | H | H | H | 1 | No | Low | | | | | 1 | Spills or leaks of produced water have the potential to result in localised salinisation or contamination of soil and unconfined shallow groundwater. Produced water is not expected to have high salinity (it is expected to be in the mid-brackish range i.e. in the order of 5,000 mg/L). Chemical dosing requirements (e.g. biocides, scale inhibitors) are likely to be low and where possible, biodegradable or UV degradable chemicals will be used. Significant concentrations of contaminants from the reservoir (e.g. hydrocarbons, metals) are not expected to be present. Unconfined groundwater (which is expected to be at a depth of 5-10 m or more at the sites) is expected to be saline (in the order of 10,000 mg/L). There is no local use of unconfined groundwater and no sensitive receptors or sensitive land uses near the sites. Ponds appropriately lined (e.g. with UV stabilised HDPE). Quality control on pond construction and pond liner installation. Maximum pond fill level not exceeded. Ponds with above-ground walls / bunds to prevent surface runoff into ponds. Pond operation monitored (e.g. pond wall integrity) and repair undertaken if required. Flowlines rated and pressure tested to appropriate pressure. Evaporator operation monitored (if they are used) and measures implemented to minimise potential impacts (e.g. moving or shutting down problem evaporator units on windy days). Routine inspections of flowlines and operational areas. Minimise use of chemicals (e.g. biocides, scale inhibitors). Spills / leaks cleaned up and remediated where appropriate. Additional fencing installed where necessary to prevent stock access. Note: Water table is expected to be predominantly saline, with no use of shallow unconfined groundwater. This further mitigates the level of risk. | **LOW** |
| 6.4, Table 8 | | 'Freeform' water disposal | Access to contaminants by wildlife | H | H | H | M | H | 2 | No | High | Long | Confined | | | 3 | Salinity of produced water is expected to be lower than the salinity of the unconfined groundwater (and within the range of salinities that can be used for irrigation of grasses and some crops) and significant concentrations of contaminants are not expected to be present. Produced water expected to be fresh to brackish (i.e. not high salinity). Water quality analysis undertaken to assess suitability for freeform disposal. Disposal to freeform not undertaken if water quality is unsuitable and likely to result in relevant soil or groundwater criteria being exceeded (e.g. EPA, ANZECC or NEPM (site contamination) criteria). Site selected to minimise environmental impact ( select enclosed interdune swale with minimal perennial vegetation, avoid significant vegetation and cultural heritage sites). Use of chemicals (e.g. biocides, scale inhibitors) minimised and biodegradable or UV degradable chemicals used where available. Methods such as batch dosing and diversion of dosed water to lined ponds implemented where necessary (e.g. if freeform disposal is being used). | **LOW** |
| 6.4, Table 8 | | Interaction of stock or native fauna with lined water ponds | Entrapment of fauna leading to injury or death | H | H | H | M | H | 2 | No | Low | | | | | 1 | The presence of water disposal ponds can present an entrapment hazard to stock and wildlife (however, the area is not currently stocked, as noted above). Stock-proof fencing will be installed around the lined ponds and would preclude larger fauna species. Based on experience with similar ponds in the region, entrapment of small fauna species in ponds in the Cooper Basin is a rare occurrence (Beach 2012a). Ongoing inspection and monitoring at the sites would detect fauna entrapment if it occurs. Access to produced water also has the potential to adversely impact stock and wildlife if the quality is poor. As discussed previously, the expected water quality is not expected to be an issue for fauna that come into contact with it. Lined ponds will be fenced and freeform disposal areas would not be used if water quality is unsuitable, which further limits the potential for access by sto or wildlife. Pond construction to minimise attractiveness to birds i.e. relatively steep sides and lined with suitable polyethylene material, with no 'beaches' or vegetation. Routine surveillance monitoring will be undertaken to detect incursions. Ongoing inspection and monitoring of ponds would detect fauna activity / mortality (if it occurred). Advice from ecologist sought if required. Ponds will be temporary and will be rehabilitated following remova of liner. Water expected to be fresh to brackish and expected water quality unlikely to result in significant impacts. Increased availability of water also has the potential to increase predator abundance and adversely affect small native fauna species. This is not expected to be significant due to the short term and localised nature of the activities. | **LOW** |
| Table 8 | | | Injury or mortality of fauna if contaminated water is encountered | H | H | H | M | H | 2 | No | Low | | | | | 1 | | **LOW** |
| 6.7, Table 8 | | Flaring and air emissions | Disturbance to native fauna by light and noise emissions | H | H | H | H | H | 1 | No | High | Short | Confined | | | 2 | Noise and air emissions generated at the well sites during the proposed operations will be localised and short term and are not likely to have a significant noise or air quality impact. There are no residences in the area. Equipment will be operated and maintained in accordance with specifications in order to minimise noise and air emissions. Well flow diverted to separator as soon as practicable to minimise gas not being captured and sent to flare. Flaring during production testing kept to minimum length of time necessary to establish resource and production parameters. Equipment and piping designed, constructed and pressure tested in accordance with relevant standards and guidelines. Monitoring of well parameters during testing operations to check for potential for fugitive emissions at the wellbore. Remote location of well sites. Note: Greenhouse gas emissions recorded and reported in accordance with NGER requirements. | **LOW** |
| 6.4, Table 8 | | Presence of personnel, site activities, noise emissions | Disturbance to wildlife | H | H | H | H | H | 1 | No | High | Short | Confined | | | 2 | Any direct impacts to fauna will be short term and localised and, given that the activities will impact an extremely small proportion of available habitat, are not likely to significantly impact any fauna populations. Site selection to avoid significant disturbance to wildlife, pastoral residences or tourist sites. Plant and equipment operated and maintained in accordance with manufacturer specifications. Remote location of well sites. Maintain a high standard of 'housekeeping' to minimise visual impact. Access to produced water also has the potential to adversely impact stock and wildlife if the quality is poor. As discussed previously, the expected water quality is not expected to be an issue for fauna that come into contact with it. Lined ponds will be fenced and freeform disposal areas would not be used if water quality is unsuitable, which further limits the potential for access by stock or wildlife. Noise a air emissions generated at the well sites during the proposed operations will be localised and short term and are not likely to have a significant noise or air quality impact. There are no residences in the area. Equipment will be operated and maintained in accordance with specifications in order to minimise noise and air emissions. Flaring during production testing would be kept to minimum length of time necessary to establish resource and production parameters. | **LOW** |
| 6.6, Table 8 | | Explosion or fire | Burning of vegetation and habitat | L | L | L | H | H | 4 | No | Low | | | | | 1 | The activities will be carried out at established well sites which are remote from public roads and where public access is limited. All production testing equipment designed and constructed in accordance with relevant standards (e.g. AS3000, AS1940, AS 2885). Safety, testing, maintenance and inspection procedures are implemented. Establishment of appropriate emergency / spill response procedures for explosion or fire. Appropriate fire fighting equipment at production test sites. Erection of signage and, where required, fencing to delineate restricted / hazardous areas. Safe work permits be obtained to ensure only individuals with proper clearance can conduct wor Smoking only in designated areas located away from equipment or activity. Petrol vehicles to be excluded from restricted areas. Appropriate firebreaks are maintained. | **LOW** |
| | | | Injury to or loss of native fauna | L | L | L | H | H | 4 | No | Low | | | | | 1 | | **LOW** |
| 6.4, Table 8 | | Spill or leaks associated with fuel or chemical storage and handling | Damage to native vegetation and wildlife habitats | H | H | H | H | H | 1 | No | Low | | | | | 1 | Access to fuel and chemicals and produced water presents a potential hazard to stock and to some native fauna. Implementation of appropriate chemical and fuel storage and handling procedures, in accordance with Safety Data Sheets and relevant standards and guidelines, including AS 1940, EPA guidelines 080/12 Bunding and Spill Management and the Australian Dangerous Goods Code (ADG). Appropriate drip capture / spill capture methods implemented in refuelling areas (e.g. use of drip trays or liners). Emergency/spill response procedures in place and appropriate spill response equipment is available on site. Personnel have received training in the use of spill response equipment. Spills or leaks are immediately reported and clean-up actions initiated. Fencing of contaminated areas if threat is posed to stock or wildlife. | **LOW** |
| | | | Access to contaminants by wildlife | H | H | H | H | H | 1 | No | Low | | | | | 1 | | **LOW** |
| 6.2, 6.4, Table 8 | | Storage, handling and disposal of waste | Damage to native vegetation and wildlife habitats | H | H | H | H | H | 1 | No | Low | | | | | 1 | Inappropriately managed waste has the potential to result in localised disturbance or contamination of soil and shallow groundwater. Waste generation minimised (e.g. by compliance with EPA's Waste Hierarchy model (avoid, reduce, reuse, recycle, recover, treat, dispose)). High standards of 'housekeeping' implemented. Waste removed off-site and disposed of at an EPA licensed waste handling facility. Secure systems used for storage and transport of waste (e.g. covered bins in designated area for waste collection and storage prior to transport). Hazardous wastes handled in accordance with relevant legislation and standards. Licensed contractors used for waste transport. All wastewater is disposed in accordance with the South Australian Public Health (Wastewater) Regulations 2013 or to the satisfaction of the Department of Health. Covered bins will be used to prevent fauna accessing or spreading waste. | **LOW** |
| | | | Attraction of scavenging animals (native / pest species) | H | H | H | M | H | 2 | No | Low | | | | | 1 | | **LOW** |
| | | | Access to contaminants by wildlife | H | H | H | M | H | 2 | No | Low | | | | | 1 | | **LOW** |
| 4.5 | ***Sensitive Area Impacts*** | | | | | | | | | | | | | | | | The Strzelecki Regional Reserve is intersected by PEL 96 and the eastern boundary is located approximately 3.5 km west of the Klebb-1 well location. The Regional Reserve was proclaimed in 1991 and includes over 800,0 ha of the vast pale sand dune country of the Strzelecki and Cobbler Deserts, and the mostly dry bed of the Strzelecki Creek (DEWNR 2013). Strzelecki Desert environments, including the Strzelecki Creek, which bisects the reserve and serves as an overflow of the Cooper Creek and a major feeder stream to Lake Blanche (a shallow freshwater ephemeral lake), are conserved within the Regional Reserve. Biological conservation, recreational tourism and petroleum exploration and production are the main land uses within the reserve (DEH 2002). | |
| 2.2 | | Disturbance to Strzelecki Regional Reserve | Loss of conservation value | H | H | H | H | H | 1 | No | Low | | | | | 1 | The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated, as discussed in Section 6.2. The National Parks and Wildlife Act 1972 provides for the establishment and management of reserves and the conservation of wildlife in a natural environment. Within the Cooper Basin, Innamincka Regional Reserve, Strzelecki Regional Reserve and Coongie Lakes National Park established under this Act. This Act provides the Department of Environment, Water and Natural Resources rights as landowner and direct involvement in the approval of Petroleum and Geothermal Energy Act licences and Statements of Environmental Objectives that cover the regional reserves (which must be approved by the Minister for Environment and Conservation). The western part of PEL 96 intersects Strzelecki Regional Reserve, however the Klebb and Le Chiffre sites are outside this reserve. | **LOW** |
| 2.1, 2.2 | | Significant Impacts on Matters of National Environmental Significance (MNEP) | Loss of conservation value | H | H | H | H | H | 1 | No | Low | | | | | 1 | Approval under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is required for activities that will, or are likely to, impact matters of national environmental significance including World Heritage properties, National Heritage places, Ramsar wetlands of international importance, listed threatened species and ecological communities, listed migratory species and a water resource, in relation to coal seam gas development and large coal mining development. The proposed exploration and appraisal production testing is a small scale project, and as discussed in Section 6, is not likely to have a significant impact on any matters national environmental significance. In particular, Strike consider that the project will not have a significant impact on a water resource given its small scale, short term nature and relatively low intensity (see Sections 6.1 and 6.3). Consequently, Strike believes that a requirement for approval under the Act is not likely to be triggered. Strike will continue to review proposed activities against the EPBC Act triggers and will submit a referral under the Act if necessary. South Australia is a signatory to the National Partnership Agreement on Coal Seam Gas and Large Coal Mining Development, and as a consequence, coal seam gas and large coal mining projects must be referred by DSD to the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) for advice. Where projects under the Petroleum and Geothermal Energy Act are to be referred under the South Australian referral protocol, it would generally be when an EIR and draft SEO are available. The state government regulator (DSD) will refer the EIR and draft SEO to the Independent Expert Scientific Committee (IESC) for advice. | **LOW** |
| | ***Air impacts*** | | | | | | | | | | | | | | | | | |
| 3.2, 6.7, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Generation of dust | H | H | H | H | H | 1 | No | High | Short | Confined | | | 2 | Noise and air emissions generated at the well sites during the proposed operations will be localised and short term and are not likely to have a significant noise or air quality impact. There are no residences in the area. Equipment will be operated and maintained in accordance with specifications in order to minimise noise and air emissions. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practical Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Areas of sensitivity (e.g. flora with significant conservation value, cultural heritage exclusion areas) flagged and / or fenced off where necessary to prevent disturbance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notificati / management of works and site issues including livestock management. (Note: Area is currently not stocked). Dust suppression measures implemented where required. Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requirements (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. | **LOW** |
| 6.1.2, Table 8 | | Loss of well integrity | Emissions to the atmosphere | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | A loss of well integrity could result in the leakage of reservoir fluids or hydrocarbons to aquifers or cross-flow between aquifers that are normally isolated. The risk is reduced to as low as possible by well design and construct and managed through operational monitoring and maintenance. Aquifers isolated behind casing string(s), cemented to surface. New casing and wellhead installed. Casing and wellhead designed to meet pressure, temperature, operational stresses and loads. Cement bond logs run to confirm quality of cement. Where there is evidence of insufficient isolation, remedial action is conducted. Well control equipment used during workover activities. Installation of tubing string for production testing. Ongoing well integrity monitoring. Emergency response plan in place and drills conducte**Note: Well integrity is managed under Drilling SEO (Santos 2009).** | **LOW** |
| 6.7, Table 8 | | Flaring and air emissions | Reduction in local air quality | H | M | H | H | H | 2 | No | Low | | | | | 1 | Noise and air emissions generated at the well sites during the proposed operations will be localised and short term and are not likely to have a significant noise or air quality impact. There are no residences in the area. Equipment will be operated and maintained in accordance with specifications in order to minimise noise and air emissions. Equipment operated and maintained in accordance with manufacturer specifications. Well flow diverted to separator as soon as practicable to minimise gas not being captured and sent to flare. Flaring during production testing kept to minimum length of time necessary to establish resource and production parameters. Equipment and piping designed, constructed and pressure tested in accordance with relevant standards and guidelines. Monitoring of well parameters during testing operations to check for potential for fugitive emissions at the wellbore. Remote location of well sites. Note: Greenhouse gas emissions recorded and reported in accordance with NGER requirements. | **LOW** |
| | | | Generation of greenhouse gas emissions | H | M | H | H | H | 2 | No | Med | Short | Confined | | | 2 | | **LOW** |
| 6.6, Table 8 | | Explosion or fire | Atmospheric pollution | L | L | L | H | H | 4 | No | Low | | | | | 1 | A fire or explosion can pose a danger to personnel, contractors and possibly the public. The activities will be carried out at established well sites which are remote from public roads and where public access is limited. All production testing equipment designed and constructed in accordance with relevant standards (e.g. AS3000, AS1940, AS 2885). Safety, testing, maintenance and inspection procedures are implemented. Establishment of appropriate emergency / spill response procedures for explosion or fire. Appropriate fire fighting equipment at production test sites. Erection of signage and, where required, fencing to delineate restricted / hazardous areas. Safe work permits be obtained to ensure only individuals with proper clearance can conduct works. Smoking only in designated areas located away from equipment or activity. Petrol vehicles to be excluded from restricted areas. Appropriate firebreaks are maintained. | **LOW** |
| | **Social Environment** | | | | | | | | | | | | | | | | | |
| 4.5 | ***Community Resource Impacts*** | | | | | | | | | | | | | | | | The well sites are not visible or readily accessible to members of the public, Le Chiffre is 6 km west of the Strzelecki Track and Klebb is 15 km west of the track. Signs will be used to indicate that no unauthorised access is allowed. The Strzelecki Regional Reserve7 is intersected by PEL 96 and the eastern boundary is located approximately 3.5 km west of the Klebb-1 well location. The Regional Reserve was proclaimed in 1991 and includes over 800,000 ha of the vast pale sand dune country of the Strzelecki and Cobbler Deserts, and the mostly dry bed of the Strzelecki Creek (DEWNR 2013). The area is isolated and sparsely populated – the town of Lyndhurst is more than 200 km to the south-west and Marree lies approximately 175 km to the west. Strike is undertaking targeted consultation with key stakeholders during the preparation of this EIR. | |

| | | | | ABBREVIATIONS: H = High certainty; M = Medium certainty; L = Low certainty | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | PREDICTABILITY | | | | | | MANAGEABILITY | | | | | | | | |
| REF | TYPE OF IMPACT | EVENT(S) | POTENTIAL CONSEQUENCES | SIZE | SCOPE | DURATION | FREQUENCY | STAKEHOLDERS | SIGNIFICANCE | AVOIDANCE | PROBABILITY | DURATION | SIZE AND SCOPE | CUMULATIVE EFFECTS | STAKEHOLDERS | SIGNIFICANCE | SUPPORTING INFORMATION & COMMENTS | Environmental significance |
| 3.2, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Visual Impact | H | H | H | H | H | 1 | No | Low | | | | | 1 | The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated, as discussed in Section 6.2. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practicable. Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Areas of sensitivity (e.g. flora with significant conservation value, cultural heritage exclusion areas) flagged and / or fenced off where necessary to prevent disturbance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notification / management of works and site issues including livestock management. (Note: Area is currently not stocked). Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requirements (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. | **LOW** |
| 4.5, 6.5, 6.7, Table 8 | | Presence of personnel, site activities, noise emissions | Visual Impact | H | H | H | H | H | 1 | No | Low | | | | | 1 | The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated. The Strzelecki Regional Reserve is intersected by PEL 96 and the eastern boundary is located approximately 3.5 km west of the Klebb-1 well location. The well sites are not visible or readily accessible to members of the public. Le Chiffre is 6 km west of the Strzelecki Track and Klebb is 15 km west of the track. Signs will be used to indicate that no unauthorised access is allowed. Site selection to avoid significant disturbance to wildlife, pastoral residences or tourist sites. Plant and equipment operated and maintained in accordance with manufacturer specifications. Remote location of well sites. Maintain a high standard of 'housekeeping' to minimise visual impact. Noise and air emissions generated at the well sites during the proposed operations will be localised and short term and are not likely to have a significant noise or air quality impact. There are no residences in the area. Equipment will be operated and maintained in accordance with specifications in order to minimise noise and air emissions. Flaring during production testing would be kept to minimum length of time necessary to establish resource and production parameters. | **LOW** |
| 6.2, 6.5, Table 8 | | Storage, handling and disposal of waste | Litter/loss of visual amenity | H | H | H | H | H | 1 | No | Low | | | | | 1 | The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated. Inappropriately managed waste has the potential to result in localised disturbance or contamination of soil and shallow groundwater. Waste generation minimised (e.g. by compliance with EPA's Waste Hierarchy model (avoid, reduce, reuse, recycle, recover, treat, dispose)). High standards of 'housekeeping' implemented. Waste removed off-site and disposed of at an EPA licensed waste handling facility. Secure systems used for storage and transport of waste (e.g. covered bins in designated area for waste collection and storage prior to transport). Hazardous wastes handled in accordance with relevant legislation and standards. Licensed contractors used for waste transport. All wastewater is disposed in accordance with the South Australian Public Health (Wastewater) Regulations 2013 or to the satisfaction of the Department of Health. Covered bins will be used to prevent fauna accessing or spreading waste. | **LOW** |
| 4.6, 4.7.1, | ***Cultural & Heritage Impacts*** | | | | | | | | | | | | | | | | PEL 96 intersects the Yandruwandha / Yawarrawarrka Native Title Claim (SC98/1) and is covered by the Yandruwandha / Yawarrawarrka Native Title Petroleum Conjunctive Indigenous Land Use Agreement. Before Strike conducts activities, work area clearances are undertaken with representatives engaged from the Native Title group. The region is culturally significant to the traditional Aboriginal owners. The Cooper Creek system (including Strzelecki Creek) was an important focus of Aboriginal occupation. Evidence of long term occupation includes burial sites, trade and ceremonial sites scattered with grinding stones and other artefacts associated with habitation. Aboriginal sites can still be identified throughout the region and include features of spiritual importance and archaeological sites: for example middens, artefact scatters, rock engravings, arrangement sites, burial sites and quarries (Blackley et al. 1996). Work Area Clearances are carried out with the Yandruwandha / Yawarrawarrka Native Title group in advance of all activities to ensure that cultural heritage values and significant places are not impacted. Work Area Clearances carried out to date for the Klebb-1, Klebb extension and Le Chiffre sites have indicated that Strike's activities will cause no impacts on any areas or objects that are known to be of cultural importance, provided that the strategy of site avoidance based on the results of the Work Area Clearance survey is implemented. Non-indigenous heritage in the region dates back to early exploration of the region in the mid to late 1800's and the expansion of pastoralism. Many of the historical sites in the region are associated with the failed Burke and Wills expedition of 1860-61 (including the Dig Tree and grave sites along Cooper Creek) and the subsequent settlement of inland South Australia and Queensland and the establishment of transport routes and pastoralism (DPTI 2014, AHPI 2014). There are no known sites of non-Aboriginal heritage significance at or adjacent to the well sites. Strike is undertaking targeted consultation with key stakeholders during the preparation of this EIR. | |
| 6.8, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Damage to cultural heritage sites | H | H | H | H | H | 1 | No | Low | | | | | 1 | Potential impacts to cultural heritage arise mainly from activities occurring outside designated / approved areas. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practicable. Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Areas of sensitivity (e.g. flora with significant conservation value, cultural heritage exclusion areas) flagged and / or fenced off where necessary to prevent disturbance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notificati / management of works and site issues including livestock management. (Note: Area is currently not stocked). Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requireme (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. | **LOW** |
| 4.5 | ***Community Health & Safety*** | | | | | | | | | | | | | | | | The Strzelecki Regional Reserve7 is intersected by PEL 96 and the eastern boundary is located approximately 3.5 km west of the Klebb-1 well location. The Regional Reserve was proclaimed in 1991 and includes over 800,000 ha of the vast pale sand dune country of the Strzelecki and Cobbler Deserts, and the mostly dry bed of the Strzelecki Creek (DEWNR 2013). Strzelecki Desert environments, including the Strzelecki Creek, which bisects the reserve and serves as an overflow of the Cooper Creek and a major feeder stream to Lake Blanche (a shallow freshwater ephemeral lake), are conserved within the Regional Reserve. Biological conservation, recreational tourism and petroleum exploration and production are the main land uses within the reserve (DEH 2002). The area is isolated and sparsely populated – the town of Lyndhurst is more than 200 km to the south-west and Marree lies approximately 175 km to the west. The small town of Innamincka is more than 150 km to the north-east. The closest residence is the Merty Merty station homestead, approximately 55 km north of the well sites. The Lindon station homestead is approximately 80 km to the east. The main transport infrastructure in the PEL 96 region is the largely unsealed Strzelecki Track which connects Innamincka and Lyndhurst and forms the longest stretch of road between towns in the South Australian Road Network (DTEI 2008). It is utilised by the oil and gas industry, tourists, pastoralists and local communities and carries a relatively high traffic volume that is predominantly a mix of heavy vehicles, light industrial / pastoral vehicles and tourist vehicles. Local station access roads and internal tracks are generally restricted to pastoral use or occasional tourist traffic and carry a low volume of traffic. The well sites are not visible or readily accessible to members of the public. Le Chiffre is 6 km west of the Strzelecki Track and Klebb is 15 km west of the track. Signs will be used to indicate that no unauthorised access is allowed. Strike is undertaking targeted consultation with key stakeholders during the preparation of this EIR. | |
| 6.1.2, Table 8 | | Loss of well integrity | Injury/danger to health and safety of employees, contractors and possibly the public | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | A loss of well integrity could result in the leakage of reservoir fluids or hydrocarbons to aquifers or cross-flow between aquifers that are normally isolated. The risk is reduced to as low as possible by well design and construc and managed through operational monitoring and maintenance. Aquifers isolated behind casing string(s), cemented to surface. New casing and wellhead installed. Casing and wellhead designed to meet pressure, temperature, operational stresses and loads. Cement bond logs run to confirm quality of cement. Where there is evidence of insufficient isolation, remedial action is conducted. Well control equipment used during workover activities. Installation of tubing string for production testing. Ongoing well integrity monitoring. Emergency response plan in place and drills conducte**(Note: Well integrity is managed under Drilling SEO (Santos 2009).** | **N/A** |
| 6.5, Table 8 | | Unauthorised third party access to site and ponds | Injury/danger to health and safety of employees, contractors and third parties | H | H | H | M | H | 2 | No | Low | | | | | 1 | The activities will be carried out at established well sites where public access is limited. The sites are also relatively remote from public roads. Measures such as signage and fencing will be in place to warn of the hazards at the site and restrict access into the site. Potentially hazardous areas such as ponds will be securely fenced with warning signs in place. Sites will be attended by an operator during production testing, enabling any unauthorised access to be detected or deterred. | **LOW** |
| 6.6, Table 8 | | Explosion or fire | Danger to health and safety of employees, contractors and possibly the public | L | L | L | H | H | 4 | No | Low | | | | | 1 | A fire or explosion can pose a danger to personnel, contractors and possibly the public. The activities will be carried out at established well sites which are remote from public roads and where public access is limited. All production testing equipment designed and constructed in accordance with relevant standards (e.g. AS3000, AS1940, AS 2885). Safety, testing, maintenance and inspection procedures are implemented. Establishment of appropriate emergency / spill response procedures for explosion or fire. Appropriate fire fighting equipment at production test sites. Erection of signage and, where required, fencing to delineate restricted / hazardous areas. Safe work permits be obtained to ensure only individuals with proper clearance can conduct works. Smoking only in designated areas located away from equipment or activity. Petrol vehicles to be excluded from restricted areas. Appropriate firebreaks are maintained. | **LOW** |
| | **Economic Environment** | | | | | | | | | | | | | | | | | |
| 4.5 | ***Community Resource/Existing Land Use Impacts*** | | | | | | | | | | | | | | | | The region is located in the unincorporated (i.e. out of councils) area of South Australia. Jurisdiction for the area falls under the responsibility of the Outback Communities Authority which provides limited local government-type support. The main land use in the region is livestock grazing (cattle) and there is a long history of pastoralism in the region. The floodplains surrounding the Cooper Creek in particular (north of PEL 96) provide pasture and reliable water supplies in the form of permanent waterholes. The well sites are located on the Lindon pastoral lease which is largely covered by PEL 96. The area involved is currently not stocked and is only occasionally stocked. The Cooper Basin has become a major supplier of oil and gas in Australia since the discovery of gas reserves at Gidgealpa, near Moomba, in 1963. The Moomba plant is approximately 110 km north of the well sites. The Moomba to Adelaide gas pipeline and the adjacent Santos Moomba to Port Bonython liquids pipeline pass through PEL 96, approximately 4 km east of Klebb and 3 km west of Le Chiffre. The Strzelecki Regional Reserve7 is intersected by PEL 96 and the eastern boundary is located approximately 3.5 km west of the Klebb-1 well location. The Regional Reserve was proclaimed in 1991 and includes over 800,000 ha of the vast pale sand dune country of the Strzelecki and Cobbler Deserts, and the mostly dry bed of the Strzelecki Creek (DEWNR 2013). The area is isolated and sparsely populated – the town of Lyndhurst is more than 200 km to the south-west and Marree lies approximately 175 km to the west. The small town of Innamincka is more than 150 km to the north-east. The closest residence is the Merty Merty station homestead, approximately 55 km north of the well sites. The Lindon station homestead is approximately 80 km to the east. The main transport infrastructure in the PEL 96 region is the largely unsealed Strzelecki Track which connects Innamincka and Lyndhurst and forms the longest stretch of road between towns in the South Australian Road Network (DTEI 2008). The well sites are not visible or readily accessible to members of the public, Le Chiffre is 6 km west of the Strzelecki Track and Klebb is 15 km west of the track. Signs will be used to indicate that no unauthorised access is allowed. Strike is undertaking targeted consultation with key stakeholders during the preparation of this EIR. | |
| 6.5, Table 8 | | Earthworks associated with construction (e.g. ponds, flowlines) and rehabilitation | Disturbance to livestock | H | H | H | H | H | 1 | No | Low | | | | | 1 | The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated, as discussed in Section 6.2. Activities confined to existing cleared areas (e.g. access roads, prepared well lease) where practicable. Minimise areas of new disturbance. Where additional earthworks required, site selected to minimise environmental impact (e.g. avoid sloping areas where practicable, avoid significant vegetation and cultural heritage sites). Significant disturbance to drainage patterns avoided (e.g. road construction at (or not significantly above) natural surface, surface water flows maintained, overland flows diverted around lease or ponds where required). Stabilise and control areas where there is potential for (or signs of) soil erosion or sedimentation occurring. All disturbance contained within area subject to environmental assessment and cultural heritage Work Area Clearance. Training and induction for all personnel to educate them on the importance of remaining within designated / approved areas. Landowner liaison regarding notification / management of works and site issues including livestock management. (Note: Area is currently not stocked). Vehicle and equipment washdown undertaken before entering Cooper Basin or after operating in areas of known weed infestations. Reinstate disturbed areas promptly once they are no longer required in accordance with Drilling SEO requirements (Santos 2009) e.g. by backfilling excavations, restoring natural contours, ripping areas of compacted soil and respreading topsoil and stockpiled vegetation. Any direct impacts to fauna will be short term and localised, and given that the activities will impact an extremely small proportion of available habitat, are not likely to significantly impact any fauna populations. **(note - the area is not currently stocked).** | **LOW** |
| 6.1.1, Table 8 | | Water extraction / drawdown in Patchawarra coals | Adverse impacts on groundwater users | H | M | H | H | M | 2 | No | Low | | | | | 1 | A hydrogeological assessment has been undertaken to assess the potential impacts of the multi-well production testing program on GAB aquifers (Middlemis 2014). Water production rates fall within the allocation under the WAP for petroleum co-produced water (60 ML/d industry-wide). Hydrogeological assessment using very conservative assumptions indicates expected extraction rates are well inside sustainable limits set by WAP, based on allowable drawdown at spring exclusion zones and Southwest Spring Zone boundary. It is not likely to have a significant impact on a water resource in the context of the EPBC Act (DoE 2013a), as it will not result in a change in hydrology or water quality that is of sufficient scale or intensity to reduce the current or future utility for third party users. The low number of GAB wells in the region and the distance to the closest well (40 km) indicate that there is not likely to be any significant impact to third party users if the WAP drawdown criteria at the South-west Springs Zone and Lake Blanche Spring are met. Ongoing monitoring and data collection to investigate potential impacts of extraction. | |
| 6.1.2, Table 8 | | Leakage of desorbed gas (following pressure reduction in reservoir) to overlying aquifers | Adverse impacts on groundwater users | M | M | H | H | M | 2 | No | Low | | | | | 1 | A loss of well integrity could result in the leakage of reservoir fluids or hydrocarbons to aquifers or cross-flow between aquifers that are normally isolated. The risk is reduced to as low as possible by well design and construc and managed through operational monitoring and maintenance. Leakage of desorbed gas from the target coals via pathways other than the well bore is considered to be a very low risk for this production test. Patchawarra coals are separated from overlying GAB aquifers by over 400 m of varying lithologies, including low permeability fine grained sandstones, mudstones and siltstones. Seismic information has not detected large scale faults in the central Weena Trough that connect the GAB to the Permian section. Some smaller faults are evident, which Strike believes are confined to the Permian. Fracture stimulation undertaken is small-scale and designed to remain in the Patchawarra Formation (i.e. no fracture propagation into overlying aquifers). Once production testing commences, the pressure gradient underground will result in fluids moving towards the well rather than away from t well bore. No GAB wells or GAB users in close proximity (closest is 40 km distant). Wells cased and cemented with ongoing integrity monitoring. | |
| 6.1.2, Table 8 | | Loss of well integrity | Contamination of groundwater | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | A loss of well integrity could result in the leakage of reservoir fluids or hydrocarbons to aquifers or cross-flow between aquifers that are normally isolated. The risk is reduced to as low as possible by well design and construc and managed through operational monitoring and maintenance. Aquifers isolated behind casing string(s), cemented to surface. New casing and wellhead installed. Casing and wellhead designed to meet pressure, temperature, operational stresses and loads. Cement bond logs run to confirm quality of cement. Where there is evidence of insufficient isolation, remedial action is conducted. Well control equipment used during workover activities. Installation of tubing string for production testing. Ongoing well integrity monitoring. Emergency response plan in place and drills conducte**(Note: Well integrity is managed under Drilling SEO (Santos 2009).** | **N/A** |
| 6.1.3, Table 8 | | Water supply / use | Adverse impacts on groundwater users | H | H | H | H | H | 1 | Yes | | | | | | 1 | Limited volumes of water will need to be supplied for the production testing. The water bores at Klebb and Le Chiffre would be preferentially used if required. If other bores need to be utilised, they would be accessed in consultation with bore owners. Water extraction in compliance with licensing and water allocations under FNPWA Water Allocation Plan where applicable. Water supply wells reviewed to ensure that their use does not impact adversely on existing users of groundwater or groundwater dependent ecosystems. Options for alternative water supplies investigated / used where possible (e.g. reuse of produced water). Monitoring of water extraction volumes. | **LOW** |

ABBREVIATIONS: H = High certainty; M = Medium certainty; L = Low certainty

| | | | | PREDICTABILITY | | | | | | MANAGEABILITY | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REF | TYPE OF IMPACT | EVENT(S) | POTENTIAL CONSEQUENCES | SIZE | SCOPE | DURATION | FREQUENCY | STAKEHOLDERS | SIGNIFICANCE | AVOIDANCE | PROBABILITY | DURATION | SIZE AND SCOPE | CUMULATIVE EFFECTS | STAKEHOLDERS | SIGNIFICANCE | SUPPORTING INFORMATION & COMMENTS | Environmental significance |
| 6.2, Table 8 | | Leak or spill of produced water (e.g. from lined ponds, pumps or flowlines) | Access to contaminants by stock | H | H | H | H | H | 1 | No | Low | | | | | 1 | Spills or leaks of produced water have the potential to result in localised salinisation or contamination of soil and unconfined shallow groundwater. Produced water is not expected to have high salinity (it is expected to be in the mid-brackish range i.e. in the order of 5,000 mg/L). Chemical dosing requirements (e.g. biocides, scale inhibitors) are likely to be low and where possible, biodegradable or UV degradable chemicals will be used. Significant concentrations of contaminants from the reservoir (e.g. hydrocarbons, metals) are not expected to be present. Unconfined groundwater (which is expected to be at a depth of 5-10 m or more at the sites) is expected to be saline (in the order of 10,000 mg/L). There is no local use of unconfined groundwater and no sensitive receptors or sensitive land uses near the sites. Ponds appropriately lined (e.g. with UV stabilised HDPE). Quality control on pond construction and pond liner installation. Maximum pond fill level not exceeded. Ponds with above-ground walls / bunds to prevent surface runoff into ponds. Pond operation monitored (e.g. pond wall integrity) and repair undertaken if required. Flowlines rated and pressure tested to appropriate pressure. Evaporator operation monitored (if they are used) and measures implemented to minimise potential impacts (e.g. moving or shutting down problem evaporator units on windy days). Routine inspections of flowlines and operational areas. Minimise use of chemicals (e.g. biocides, scale inhibitors). Spills / leaks cleaned up and remediated where appropriate. Additional fencing installed where necessary to prevent stock access. Note: Water table is expected to be predominantly saline, with no use of shallow unconfined groundwater. This further mitigates the level of risk **(note - the area is not currently stocked).** | **LOW** |
| 6.4, Table 8 | | 'Freeform' water disposal | Access to contaminants by stock | H | H | H | H | H | 1 | No | Low | | | | | 1 | Salinity of produced water is expected to be lower than the salinity of the unconfined groundwater (and within the range of salinities that can be used for irrigation of grasses and some crops) and significant concentrations of contaminants are not expected to be present. Produced water expected to be fresh to brackish (i.e. not high salinity). Water quality analysis undertaken to assess suitability for freeform disposal. Disposal to freeform not undertaken if water quality is unsuitable and likely to result in relevant soil or groundwater criteria being exceeded (e.g. EPA, ANZECC or NEPM (site contamination) criteria). Site selected to minimise environmental impact (i.e. select enclosed interdune swale with minimal perennial vegetation, avoid significant vegetation and cultural heritage sites). Use of chemicals (e.g. biocides, scale inhibitors) minimised and biodegradable or UV degradable chemicals used where available. Methods such as batch dosing and diversion of dosed water to lined ponds implemented where necessary (e.g. if freeform disposal is being used **(note - the area is not currently stocked).** | **LOW** |
| 6.4, Table 8 | | Interaction of stock or native fauna with lined water ponds | Entrapment of stock leading to injury or death | H | H | H | H | H | 1 | No | Low | | | | | 1 | The presence of water disposal ponds can present an entrapment hazard to stock and wildlife (however, the area is not currently stocked, as noted above). Stock-proof fencing will be installed around the lined ponds and would preclude larger fauna species. Based on experience with similar ponds in the region, entrapment of small fauna species in ponds in the Cooper Basin is a rare occurrence (Beach 2012a). Ongoing inspection and monitoring at the sites would detect fauna entrapment if it occurs. Access to produced water also has the potential to adversely impact stock and wildlife if the quality is poor. As discussed previously, the expected water quality is not expected to be an issue for fauna that come into contact with it. Lined ponds will be fenced and freeform disposal areas would not be used if water quality is unsuitable, which further limits the potential for access by stock or wildlife. Pond construction to minimise attractiveness to birds i.e. relatively steep sides and lined with suitable polyethylene material, with no 'beaches' or vegetation. Routine surveillance monitoring will be undertaken to detect incursions. Ongoing inspection and monitoring of ponds would detect fauna activity / mortality (if it occurred). Advice from ecologist sought if required. Ponds will be temporary and will be rehabilitated following removal of liner. Water expected to be fresh to brackish and expected water quality unlikely to result in significant impacts. Increased stocking rates as a result of additional watering points (e.g. unfenced freeform disposal areas) can also degrade native vegetation and habitats due to increased grazing pressure. The area is not currently stocked and stock will not be allowed to access produced water for this production testing program **(note - the area is not currently stocked).** | **LOW** |
| | | | Injury or mortality of stock if contaminated water is encountered | H | H | H | H | H | 1 | No | Low | | | | | 1 | | **LOW** |
| 6.4, 6.5, 6.7, Table 8 | | Presence of personnel, site activities, noise emissions | Disturbance to stock | H | H | H | H | H | 1 | No | Low | | | | | 1 | The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated. Site selection to avoid significant disturbance to wildlife, pastoral residences or tourist sites. Landowner liaison regarding notification / management of works and site issues including livestock management. (Note: Area is currently not stocked). Plant and equipment operated and maintained in accordance with manufacturer specifications. Remote location of well sites. Maintain a high standard of 'housekeeping' to minimise visual impact. Access to produced water also has the potential to adversely impact stock and wildlife if the quality is poor. As discussed previously, the expected water quality is not expected to be an issue for fauna that come into contact with it. Lined ponds will be fenced and freeform disposal areas would not be used if water quality is unsuitable, which further limits the potential for access by stock or wildlife. Noise and air emissions generated at the well sites during the proposed operations will be localised and short term and are not likely to have a significant noise or air quality impact. There are no residences in the area. Equipment will be operated and maintained in accordance with specifications in order to minimise noise and air emissions. Flaring during production testing would be kept to minimum length of time necessary to establish resource and production parameters **(note - the area is not currently stocked).** | **LOW** |
| | | | Disturbance to landholders and other third parties | H | H | H | H | H | 1 | No | Low | | | | | 1 | | **LOW** |
| 6.5, 6.6, Table 8 | | Explosion or fire | Damage to infrastructure | H | H | H | H | H | 1 | No | Low | | | | | 1 | A fire or explosion can pose a danger to personnel, contractors and possibly the public. The activities will be carried out at established well sites which are remote from public roads and where public access is limited. All production testing equipment designed and constructed in accordance with relevant standards (e.g. AS3000, AS1940, AS 2885). Safety, testing, maintenance and inspection procedures are implemented. Establishment of appropriate emergency / spill response procedures for explosion or fire. Appropriate fire fighting equipment at production test sites. Erection of signage and, where required, fencing to delineate restricted / hazardous areas. Safe work permits be obtained to ensure only individuals with proper clearance can conduct works. Smoking only in designated areas located away from equipment or activity. Petrol vehicles to be excluded from restricted areas. Appropriate firebreaks are maintained. The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure. | **LOW** |
| 6.4, 6.5, Table 8 | | Spill or leaks associated with fuel or chemical storage and handling | Access to contaminants by stock | H | H | H | H | H | 1 | No | Low | | | | | 1 | Access to fuel and chemicals and produced water presents a potential hazard to stock and to some native fauna. The likelihood of a spill affecting large areas of native vegetation away from the cleared well sites is very low. Implementation of appropriate chemical and fuel storage and handling procedures, in accordance with Safety Data Sheets and relevant standards and guidelines, including AS 1940, EPA guidelines 080/12 Bunding and Spill Management and the Australian Dangerous Goods Code (ADG). Appropriate drip capture / spill capture methods implemented in refuelling areas (e.g. use of drip trays or liners). Emergency/spill response procedures in place and appropriate spill response equipment is available on site. Personnel have received training in the use of spill response equipment. Spills or leaks are immediately reported and clean-up actions initiated. Fencing of contaminated areas if threat is posed to stock or wildlife. The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated **(note - the area is not currently stocked).** | **LOW** |
| 6.2, 6.5, Table 8 | | Storage, handling and disposal of waste | Access to contaminants by stock | H | H | H | H | H | 1 | No | Low | | | | | 1 | The proposed activities are not likely to have any significant impact on land uses (e.g. grazing, conservation or tourism) or landholders within the region. The sites are distant from roads or pastoral infrastructure, so will have little direct impact or visual impact, and a very small proportion of the area will be impacted. Sites will ultimately be rehabilitated. Inappropriately managed waste has the potential to result in localised disturbance or contamination of soil and shallow groundwater. Waste generation minimised (e.g. by compliance with EPA's Waste Hierarchy model (avoid, reduce, reuse, recycle, recover, treat, dispose)). High standards of 'housekeeping' implemented. Waste removed off-site and disposed of at an EPA licensed waste handling facility. Secure systems used for storage and transport of waste (e.g. covered bins in designated area for waste collection and storage prior to transport). Hazardous wastes handled in accordance with relevant legislation and standards. Licensed contractors used for waste transport. All wastewater is disposed in accordance with the South Australian Public Health (Wastewater) Regulations 2013 or to the satisfaction of the Department of Health. Covered bins will be used to prevent fauna accessing or spreading waste **(note - the area is not currently stocked).** | **LOW** |